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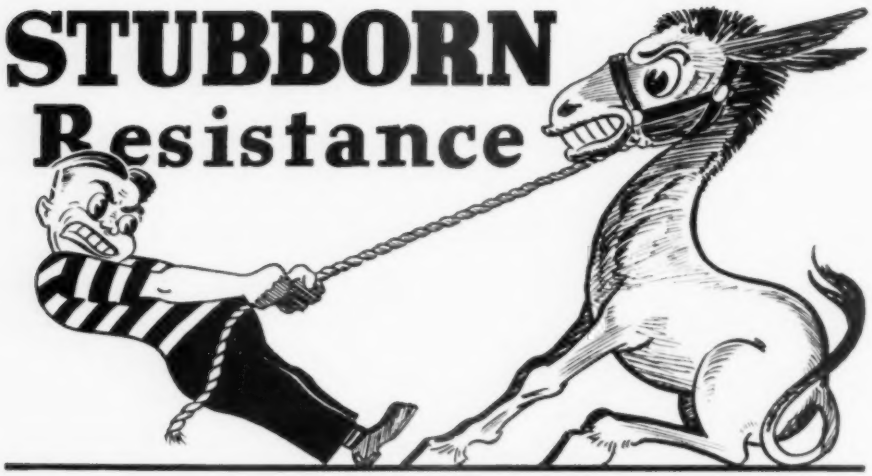

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Original Articles

EXTRAORAL ROENTGEN TECHNIQUE IN FRACTURES OF THE MANDIBLE, MAXILLA, AND ASSOCIATED STRUCTURES

EDGAR L. ABT, D.M.D., BOSTON, MASS.

THE most accurate means for the study and diagnosis of fractures of the facial bones is found in the roentgen examination. The purpose of this paper is to present as simplified a technique as is possible with the average available dental x-ray unit. A well-executed roentgenogram will record the extent of the injuries better than any word picture, and will serve as a record of the conditions immediately before treatment was instituted. The use of the x-rays will also lessen the necessity for extensive digital examination, for additional trauma can result from the injudicious manipulation of the tissues. In contrast with diagnosis by manipulation, there is little or no pain associated with the x-ray examination, except for the possible positioning of the patient. The swelling associated with fractures frequently complicates a diagnosis, and it is in such conditions that the roentgenogram becomes indispensible. Unsuspected complications are also revealed and adjustments in treatment affected.

The uses to which the x-rays are directed are manifold. They are used preoperatively to confirm the diagnosis, and to form part of a permanent record. Operatively they are used to confirm the treatment and to record any pathologic or physiologic changes; and postoperatively, to record the success of the treatment and to become a permanent part of the history of the case.

An important aspect in roentgenography in relation to fractures is the grouping of the anatomic entities so that maximum efficiency is attained. Efficient grouping will result in a greater number of views obtained for each part. At least two views of each structure should be shown, each at right angles to the other, in order to reveal any lateral displacement. Particular effort in this regard should be expended.

There are, then, four characteristics of a thorough roentgen examination in the study of fractures: (1) maximum structural detail for any tissue changes; (2) the showing of the entire involved area; (3) the showing of possibly involved adjacent tissues for inclusion or exclusion of any pathology or trauma; (4) the showing of two views of each anatomic part, one at right angle to the other.

It is desirable to make the roentgen examination as soon as possible following trauma. It is well, however, to bear in mind the following statement by Pancoast: "While there is nothing about the procedure that should be injurious or dangerous, we insist that the patient should be entirely out of shock before any roentgen examination is undertaken."[1] Any other emergency treatment that may be necessary should, of course, be undertaken before the roentgen examination.

It is well to have the case history at hand before starting the roentgen examination, for this will aid the roentgenologist in determining the views necessary to best depict the fractures. All fractures are not accompanied by histories of trauma, some being due to local pathologic conditions. Thoma lists malignant tumors, benign tumors, cysts, and general skeletal diseases as some of the causes of pathologic fractures.[2] The roentgen approach to such fractures would undoubtedly be different from that to fractures resulting from violent trauma.

The general principles of roentgen technique are to be carefully observed in an x-ray survey for fractures. Distortion is an ever-possible complication, and every effort should be made to reduce it to a minimum. Although it is not always possible to have exact parallelism of object and film, particular attention should be paid in this respect, so that the distortion will take more the form of a magnification, than an unequal distortion of parts. A second factor is the right angle projection of the rays to the object and film, or as nearly so as possible. A third factor is the placing of the film in as direct contact with the object as is possible, for then distortion and magnification are kept at a minimum. If a relatively close contact cannot be had, such a fact can be compensated for by increasing the target-film distance.

The smaller the depicted area, the less distortion will result, and so it is not advisable to try to include too many widely separated structures within the same roentgenogram. The peripheral rays in any focal field are more divergent than those in the center of the field, and it follows that those structures near the periphery will have more distortion. For this reason, coverage of smaller fields is recommended. In doing so, a limiting diaphragm or cone, which also cuts down the amount of secondary radiation, should be used.

Another important factor to be observed in extraoral technique is the combining of parts of somewhat equal density within the same roentgenogram. If parts are not of somewhat equal density, then, in allowing sufficient exposure to penetrate heavy or dense parts, a "burning out" of the thinner parts will result. This is exemplified by the overexposure of the nasal bones in depicting a lateral face view with an exposure sufficient to penetrate the bones of the face. Compare Fig. 13 and Fig. 14.

A comprehensive understanding of the osteology of the head is necessary in the roentgen examination for fractures. The relative positions of the various anatomic parts to each other and their densities will naturally influence the exposure factors. In many views the x-rays will of necessity penetrate four layers of compact bone, a factor in exposure technique. The internal structures, especially the sphenoid bone and the petrous portions of the temporal bone, are apt to cast their shadows over vitally important areas; a means to displace such obstructing parts should be understood.

Two methods are available to prevent obstructing anatomic parts from casting shadows over desired structures. An understanding of the divergent rays is necessary in either method. One method is to so angulate the central ray as to cast aside the obstruction, the other is to thin out or distort the obstruction. Fig. 1*A* is representative of two structures, Object A to be x-rayed and Object B the obstruction. If the central ray is so directed as to pass between the two objects, it is noticed that the divergent rays on one side of the central

ray will cast the shadow of the obstructing part away from the desired part. It is also noticed that the divergent rays on the opposite side of the central ray will actually picture Object A. The central ray acts as a fence separating the undesired from that which is desired.

The second method, that of extreme distortion, is accomplished by the use of a short target-film distance to increase the divergency of the rays (Fig. 1*B*). Object A, which is in the center of the focal field and nearer the film, will be subjected to the central rays and, hence, little distorted, while Object B, which is farther from the film, will be greatly distorted and thinned out. This thinning out will allow the desired object to appear through the obstruction. An example of this method is found in Fig. 8, showing the anterior mandible in a posterior-anterior projection. The vertebrae which are farther from the film have been thinned out, allowing the mandible to appear relatively distinctly.

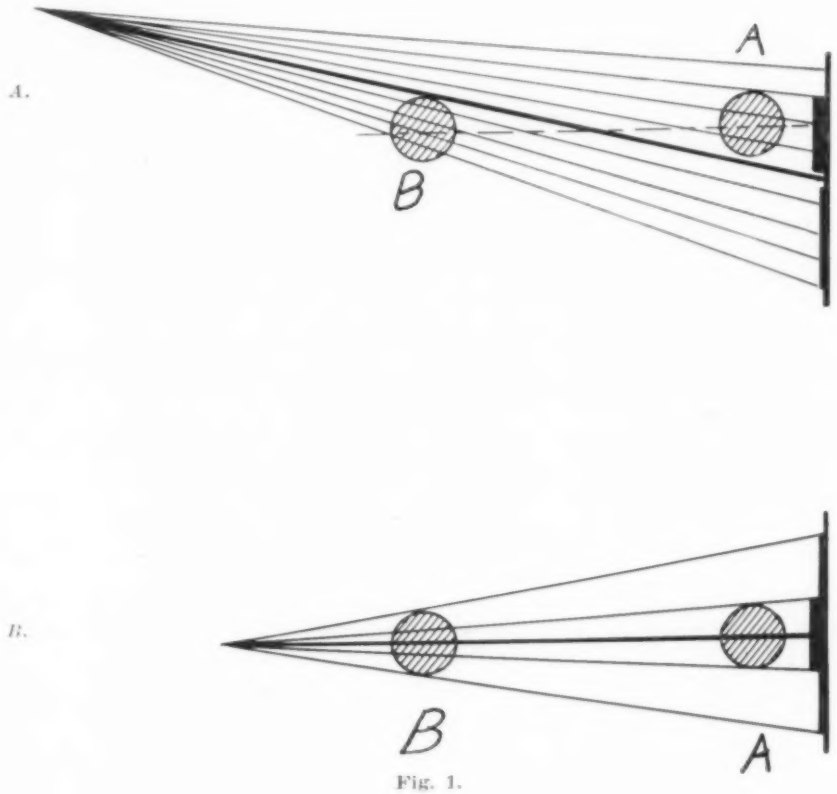


Fig. 1.

The films used in extraoral roentgenography are of two types: the nonscreen film which is used with the simple cardboard exposure holder, and the regular double emulsion speed film which is used with cassettes and intensifying screens. The nonscreen film, although not as fast as one used with intensifying screens, is sufficiently fast and possesses a great deal of latitude, resulting in a product of greater detail. Films used with intensifying screens will produce a roentgenogram of greater contrast, at the expense of detail. A popular quality in a roentgenogram is contrast, however, detail is also an essential, and the correct balance of detail and contrast is to be preferred.

The cassette with screens is used in all views except those of the profile (Fig. 14) to show the nasal bones and of the lateral jaw (Fig. 4*A* and *B*). The nonscreen film is particularly useful in lateral jaw projection because of its inherent quality of latitude; the thin parts to be found in the mental region will not be overexposed and the trabeculae will be well shown. Bone detail is essential in determining any infected areas, and since a fractured mandible is liable to infection, this film is particularly adaptable.

Time exposure is dependent on the density and thickness of a part, so that the cassette with intensifying screens is used for thick and dense anatomic parts, in order to reduce the time of exposure. The patient then is subjected to less radiation, and the possibility of movement on the part of the patient is reduced.

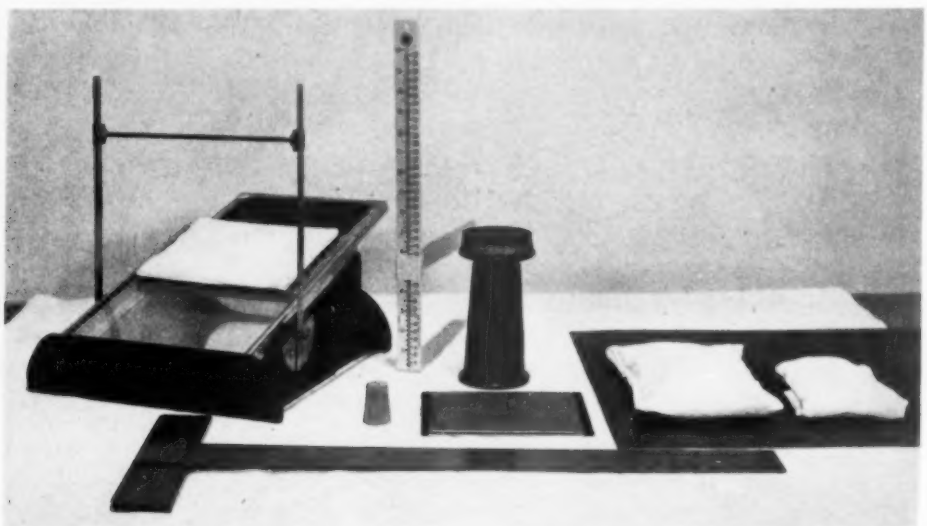


Fig. 2.—Equipment advisable for extraoral roentgenography: lead shield, intensifying screens and cassette, angle board, tissue caliper, reducing cone, film holder, sandbags, and T square. The cork is used in temporomandibular work in which views are obtained of both an opened and closed position.

Little equipment is necessary in extraoral technique other than a cassette with intensifying screens (Fig. 2). An angle board with a change tunnel, however, is a convenience although not an absolute necessity. For the encouragement of the individual not having an angle board the accompanying roentgenograms were selected, because all were produced without the aid of an angle board with the exception of the verticosubmental view of the mandible (Fig. 6).

Reducing cones or diaphragms are advisable to reduce secondary radiation, as mentioned before, and their use will result in a roentgenogram of better detail (Fig. 3), as well as in reducing the amount of radiation directed at the patient. Factors in the production of Fig. 3*A* and *B* of the same temporomandibular joint were the same, except a reducing diaphragm was used in the production of Fig. 3*B*.

Two variables, mineral content of bone and thickness of parts, exist, which must be considered in the determination of the proper amount of exposure necessary to produce a film of proper density with the desired characteristics of detail and contrast. As an example, in the production of two roentgenograms of

two similar anatomic parts using the same target-film distances, but of two different persons, two variables exist. The first is that of the age of the individual patient, wherein a thought must be directed to the possible mineral salts

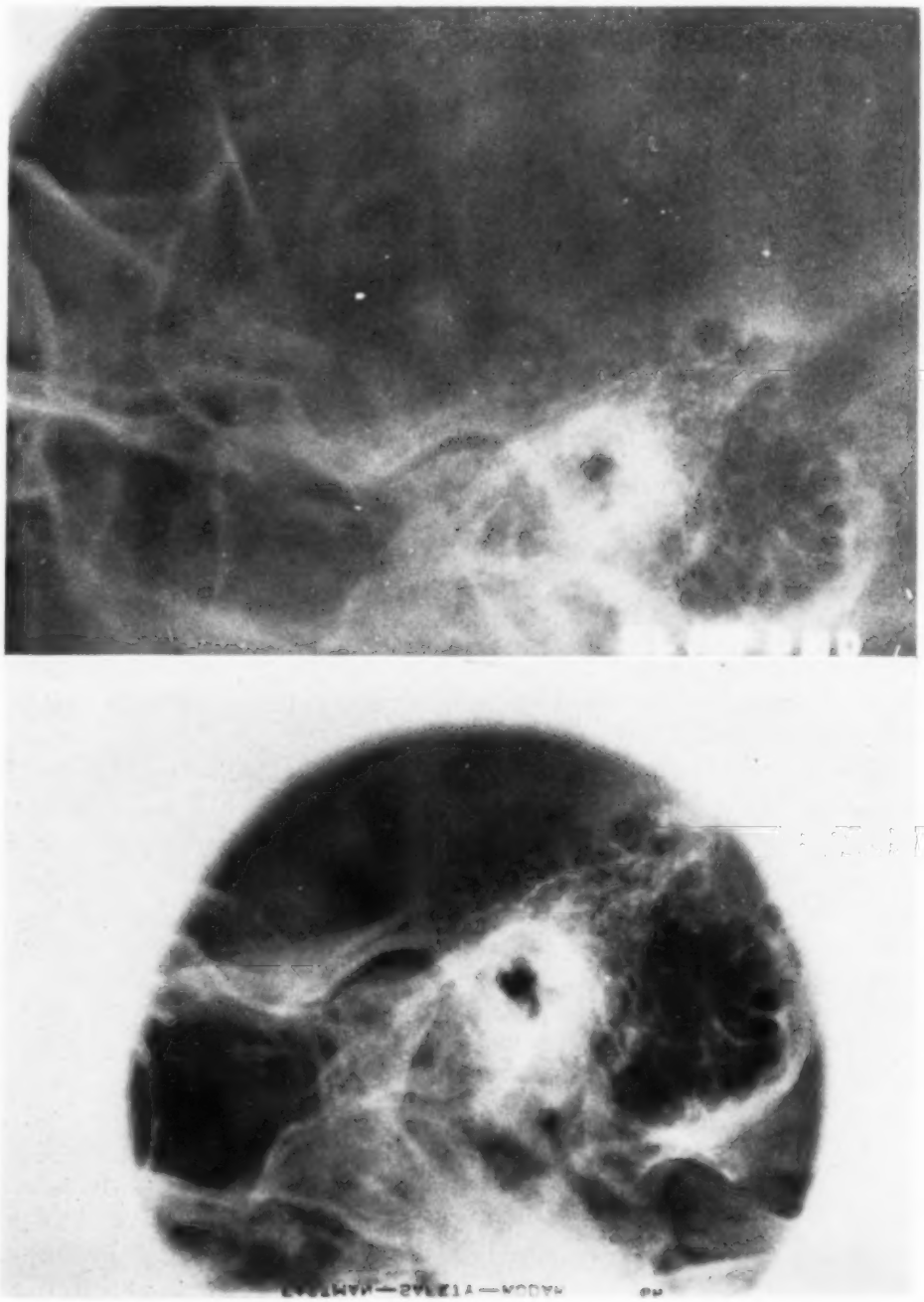


Fig. 3.—Shows the results of a temporomandibular joint resulting with a cone.

present in the bone. The young child and the elderly person generally have less of the minerals than the average adult. The exposure time will consequently vary accordingly to the possible mineral content of the bones.[3]

The second variable, that of tissue thickness, is not easy to judge by mere observation of the width or depth of the tissues to be penetrated, and so a tissue caliper is suggested as an aid in determining the amount of radiation required. Experience is the best teacher in this respect. The recording of exposure factors with the age of the patient and the thickness of the part will assist in the early accumulation of experience.

An architect's T square will be found helpful when one desires right angle projection for the longer target-film distances. Such will aid one in the perpendicular positioning of the film and in directing to the point of entry for the central ray.

If the longer target-film distances are necessary, and, consequently, longer time exposures are needed, immobilizing aids such as sandbags or bands will be advisable to guard against any movement on the part of the patient.

As has been said, the purpose of this paper is to present a technique which is possible with average available x-ray equipment as found in the usual dental office. The accompanying roentgenograms were all produced with a ten milliampere x-ray apparatus which is generally satisfactory for fracture work of the bones of the face within the realm of the dental profession. The fine focal spot of such equipment is very desirable although the exposure times are, of necessity, longer than those of more highly rated machines. Regardless of how accurately the exposures are executed, the processing of films is equally important. All may be lost if every effort is not expended in the processing room. This cannot be too greatly emphasized.

To this point, general factors in the production of roentgenograms in fracture study have been discussed. It is now possible to approach the various anatomic parts for individual study.

In x-raying the lateral mandible it is well to divide the bone into two views, one to show the body as far forward as the cuspid or mental region, the other to show the posterior part of the mandible, including the ramus, neck of the condyle, coronoid process, and the zygomatic arch. The two most common sites for fractures of the mandible are in the cuspid region and at the angle. Two views are recommended because of the differences in density found in the cuspid region and at the angle and ramus, as well as the fact that the shadows of the vertebrae are likely to be cast over the posterior mandible if the entire bone is covered in but one exposure. The techniques employed for the two views are similar except for the film placement and a slight increase in the milliampere seconds of exposure for the ramus region.

Consider first the region of the ramus and the zygomatic arch. The film should be placed firmly against the ramus in a plane parallel to the sagittal plane of the head and with the chin well extended (Fig. 5*A*). From the opposite side to that being radiographed direct the central ray to a point just posterior and below the angle of the mandible so that the central ray will strike the film in the vicinity of the third molar at its occlusal plane. The angulation preferred is minus 15 degrees and should not exceed a minus 20 degree angulation. (For the purposes of establishing a terminology as to minus or plus angulations, let it be understood that a minus angulation will indicate that the rays are directed from the caudal to the cephalic and a plus angulation

from the cephalic to the caudal. This will overcome the confusion that will possibly result if one operator uses a sitting position for the patient, while another uses a supine position (see Fig. 5*C*). If the target-film distance is in-

Fig. 4.

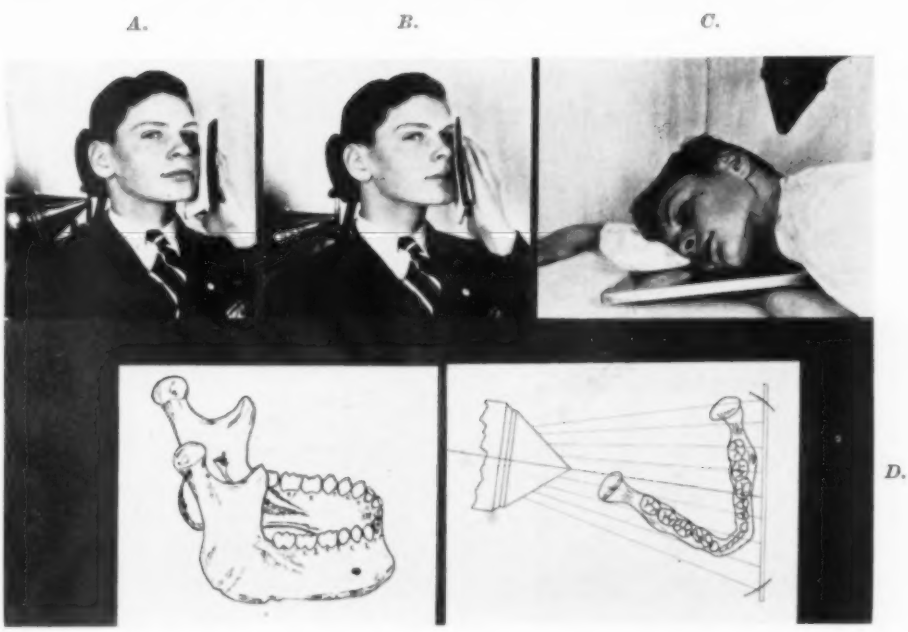


Fig. 5.

creased, it may become necessary to increase the angulation because of the lesser divergency of the rays. The divergency is used to displace the opposite jaw (Fig. 5*D*). The area shown being relatively small, the shorter distance will be sufficient, and will allow the more accurate directing of the central ray.

The nonscreen film in a cardboard holder is used, and the exposure should be from 2½ to 3½ seconds (25 to 35 milliampere seconds). The nonscreen films require longer developing than ordinary films, and so it is advisable to follow the directions accompanying the particular developer being used.

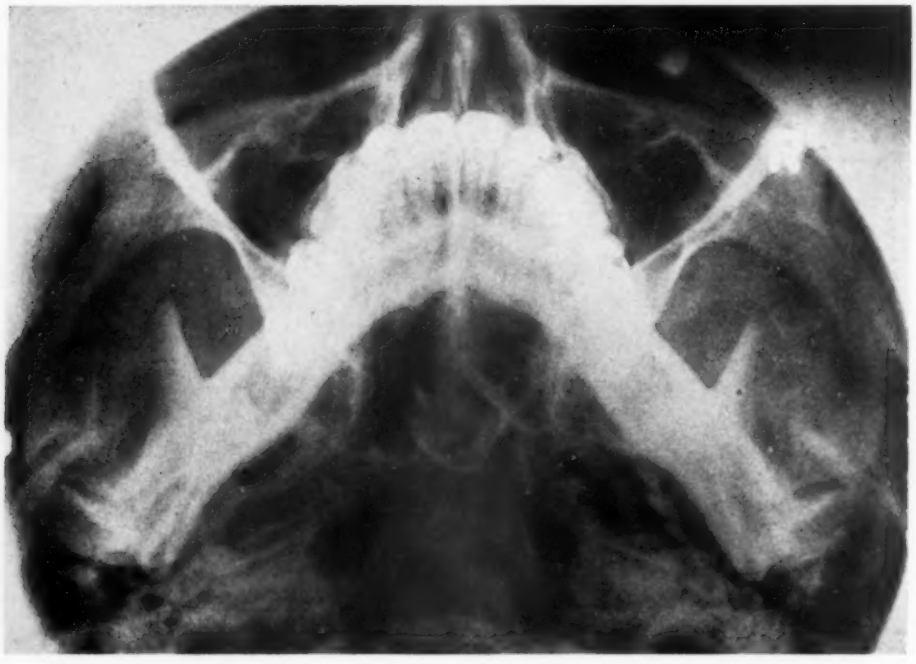


Fig. 6.

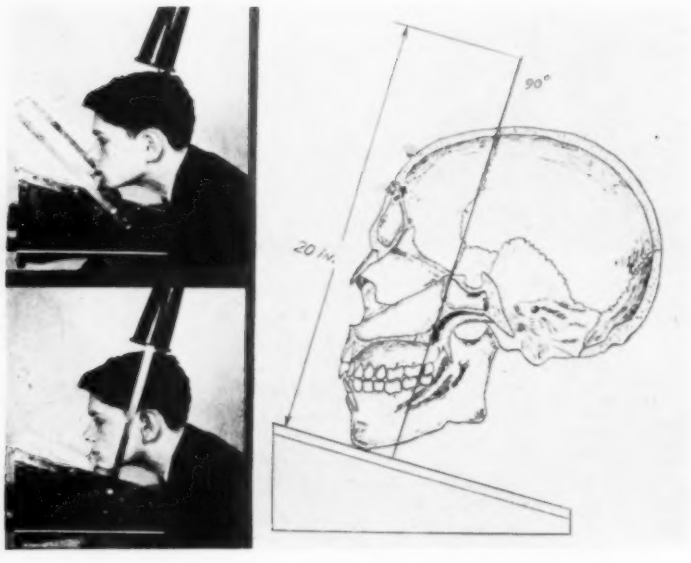


Fig. 7.

For the view of the mandible extending to the cuspid region (Fig. 4), place the film against the mandible to be studied in such a way as to permit it to come within a half inch of the tip of the nose (Fig. 5*B*). Direct the central

ray from the same position as for the ramus, but to the region of the mesial surface of the first molar at its occlusal plane. The angle preferred is not more than minus 20 degrees although, in persons with extremely narrow arches, it may be necessary to increase the angulation slightly. The nonscreen film is used with an exposure of approximately one-fourth second less than for the ramus region with a 15 inch target-film distance. This view should reveal the body of the mandible as far forward as the mental region and show the maxillary alveolar process and teeth as far forward as to include the premolars.

Fig. 8.

The verticosubmental view depicts the mandible, coronoid processes, the head of the condyles, zygomatic arches, zygomata, the anterior walls of the maxillas, the antra, and the nasal septum (Fig. 6). For this exposure a 15 degree angle board is preferred. The film placement is obtained by extending the head so the chin rests one and one-half inches forward of the center of the film, the center of the film being beneath a point representing the juncture of the sagittal plane and an imaginary line drawn between the mandibular first molars (Fig. 7). The central ray enters the skull in the region of the bregma, and passes anterior to the body of the sphenoid along the sagittal plane. It is directed at right angles to the film. High-speed intensifying screens with speed films are used for this exposure. The accompanying roentgenogram (Fig. 6) of a young

girl 17 years of age was exposed 8½ seconds (85 milliampere seconds). By experimentation it has been found that if the operator allows one second for each inch of tissue traversed by the central ray plus one second, a satisfactory exposure of proper density is procured.

The view obtained by this verticosubmental projection is of especial value. In injuries of force striking the zygoma, the zygoma is apt to be forced inward, resulting in the collapse of the thinner wall of the maxilla and the opening of the zygomatic sutures. Any lateral displacement of fragments of the mandible and zygomatic arch are also shown in such a view as well as a fractured capitulum (Fig. 6). The maxillary sinuses should be observed in this view for any cloudiness.

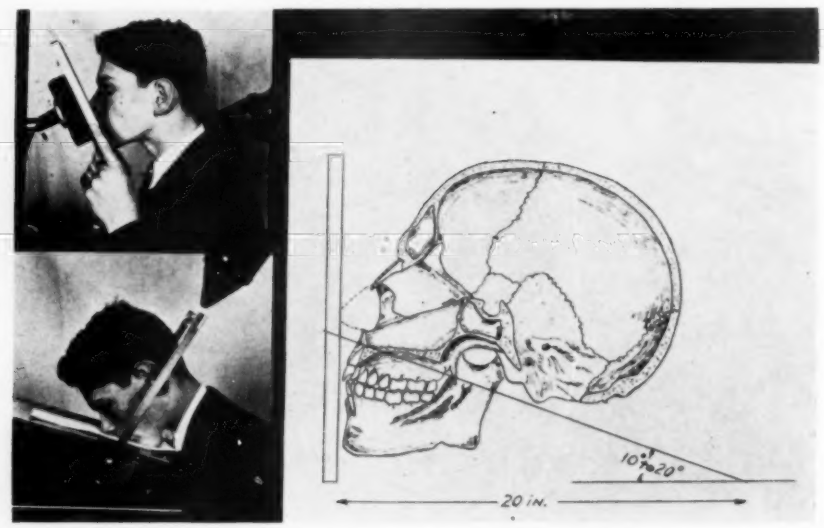


Fig. 9.

The posterior-anterior view of the mandible and maxilla can be modified for the particular purpose desired. If there is a question of a fracture in the region of the symphysis (Fig. 8), a target-film distance of 15 inches is used. This short distance is used in order to thin out the vertebrae through which the central ray must pass. The film placement is obtained by resting the face on the chin and tip of the nose, allowing no pressure lest the cartilages of the nose be distorted, and with the sagittal plane perpendicular to the film (Fig. 9). The tube is directed from the posterior to the anterior at a minus 10 degree angulation. The point of entry for the central ray is about 2 inches below the occipital protuberance, the central ray striking the film opposite the incisal edges of the anterior teeth.

Intensifying screens are used, and the exposure for a 15 inch target-film distance in a young adult, as pictured in Fig. 8, will approximate 2¼ seconds.

If this posterior-anterior view is taken to show any lateral displacement of fragments in the region of the coronoid process, the ascending ramus, or neck of the condyle, then a longer target-film distance of 24 inches is used (Fig. 10). The point of entry is the same as for the previously mentioned view, the angula-

tion from 15 to 20 degrees minus, the central ray striking the film in the region of the anterior nasal spine. It may seem contrary to expectation, but the exposure is less than for the previous view of the symphysis, due to the lesser density of the neck of the condyle as compared to the anterior mandible.

A high speed intensifying screen was used, and the exposure for a 24 inch target-film distance in a young adult, as pictured in Fig. 10, was 1½ seconds.

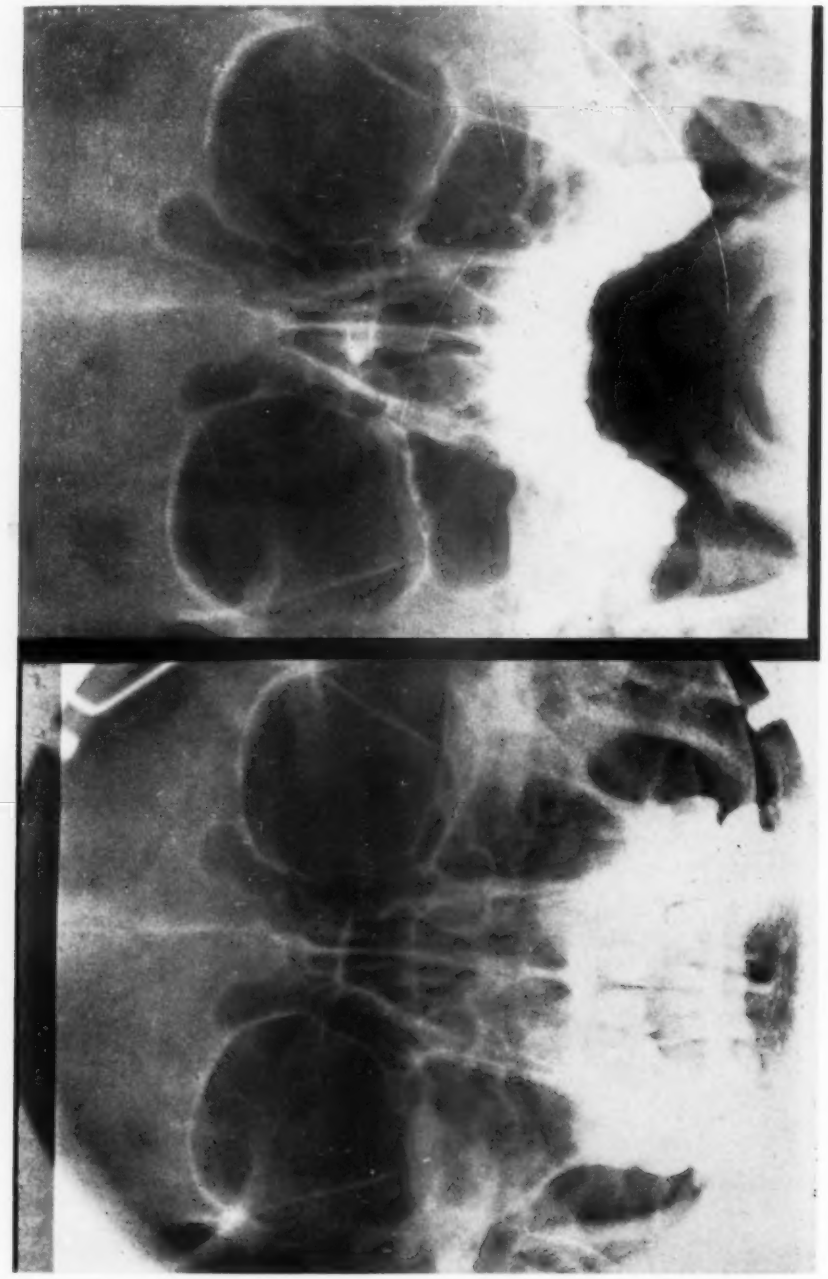
These posterior-anterior views of the mandible will also reveal the lateral and mesial walls and floor of the maxillary sinuses, and the nasal septum.

Fig. 10.

In the study of fractures of the maxillas there are problems arising which make a diagnosis rather difficult. The very irregular shape of the bone, coupled with the fact that the bone is not dense, makes the overlooking of a fracture possible. There is less likely to be a displacement of fragments due to the fact that there are not the powerful muscles of mastication as found associated with the mandible. Any displacement is apt to be a result of the force of the injury.

It is sometimes necessary to resort to intraoral roentgenography to aid in the diagnosis, particularly of the alveolar and palatine processes.

Because of the various structures in such a close relationship, a thorough knowledge of anatomy is essential in a study of such fractures. There is always



A.

B.

Fig. 11.

arising the possibility of impacted fractures, showing as increased densities. A beveled fracture by its nature is apt to be obscure. Natural suture lines and fissures, such as the orbital fissures, are likely to be confusing.

In the extraoral examination, posterior-anterior view, there is the problem of passing through the skull with the sphenoid and petrous portions of the tem-

poral bones lying posterior to the maxilla. In the previous films of the mandible, these structures were displaced upward to reveal the floors of the antra. There is also the possibility of casting them downward or passing directly through them. Careful placement of the central ray will allow the divergent rays to displace these structures. Since a fracture may take a horizontal course or extend to the infraorbital ridge or enter the floor of the orbit, it is advisable to take two views, one to project the obstructions downward, the other to pass directly through them (Fig. 11*A* and *B*). This will allow a more accurate alignment of object and film with the right angle projection of the central ray by the one position, and the displacement of parts by the other.

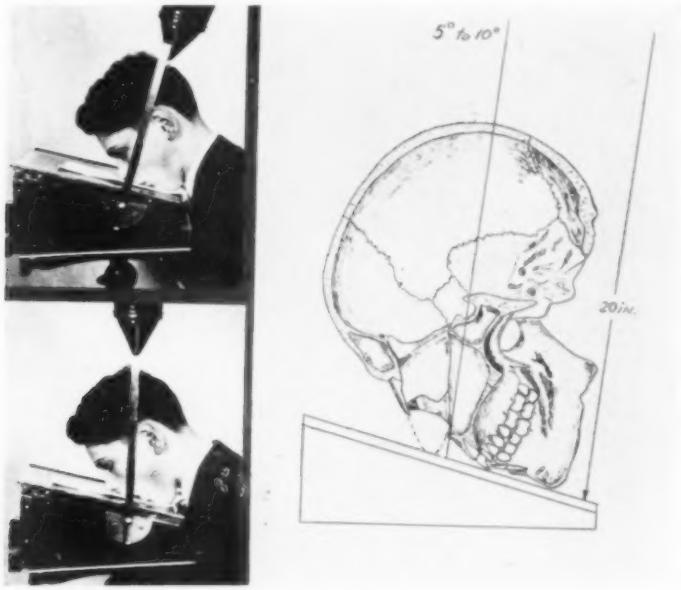


Fig. 12.

Fig. 12*A* and *B* show the relationship of the head and film. It may be preferred to hold the head erect to show the level of any fluid that may be accumulated in the antra. The use of an angle board will direct any fluid against the anterior wall and perhaps render a diagnosis of the presence of fluid less difficult. The positioning in relation to the film is similar to that for the posterior-anterior view of the mandible, that is, chin and nose in contact with the film. The mouth may be open or closed. The open mouth will possibly reduce the amount of secondary radiation.

To obtain the view (Fig. 11*B*) wherein the central ray passes through the internal structures, the central ray enters the skull above the superior nuchal line, which is avoided because of its density. The central ray is directed to the surface of the film along the sagittal plane at an angulation of plus 5 or 7 degrees, to emerge near the tip of the nose (Fig. 12*B*).

To obtain the view (Fig. 11*A*) wherein the internal obstructing anatomic parts are displaced downward, direct the central ray to pass above the body of the sphenoid. The central ray then acts as the fence to separate the desired

from the nondesired, with the divergent rays above the central ray actually exposing the maxilla. The angulation will be plus 12 degrees; the central ray will enter the skull somewhat higher and will emerge above the root ends of the anterior maxillary teeth (Fig. 12*A*). The exposure time for each view with mid-speed screens for a young adult will approximate 8 seconds. A sinus cone or a diaphragm will reduce secondary radiation.

Fig. 13.

The lateral views of the bones of the face (Fig. 13) or profile (Fig. 14) have similar techniques except for the target-film distances, and, consequently, different time exposures. In each view the film is placed against the side to be x-rayed in a plane parallel to the sagittal plane of the head (Fig. 15). The central ray, directed at right angles to the film and sagittal plane, should enter the tissues in the region of the maxillary first molar root tips.

The value of the profile view is to show the nasal bones and cartilages. For this, a nonscreen film is used at a target-film distance of 6 feet, time exposure 4 to 5 seconds. The extreme target-film distance compensates for the fact that the object and film are not in contact.

The lateral view of the facial bones is obtained by using a target-film distance of 36 inches. The angulation and point of entry are the same as for the profile view. The view illustrated of a young adult (Fig. 13) was exposed for 2½ seconds with a mid-speed screen. Notice that in order to depict the heavier facial bones, the nasal bones are "burned out."

In fractures of the mandible, it is essential to know the relationship of the condyle to the mandibular fossa (Fig. 16). After reduction of the fragments of

Fig. 14.

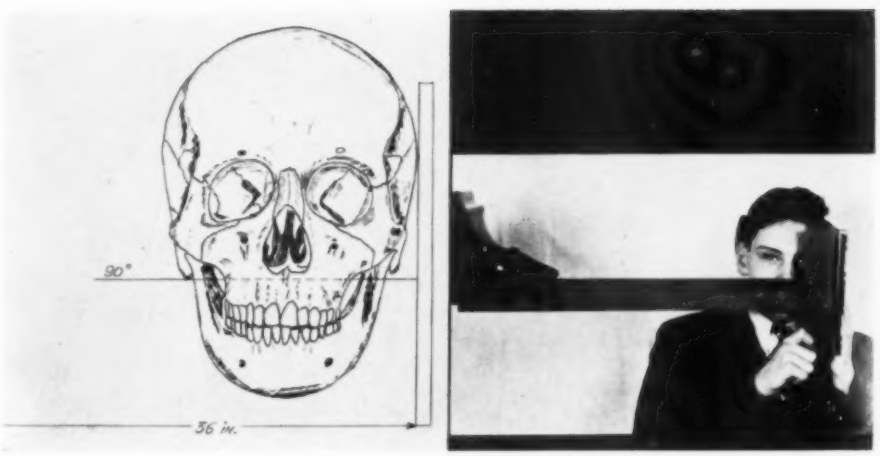


Fig. 15.

a fractured mandible, difficulty may be encountered in occluding the teeth of the opposing jaws. The force of the trauma may displace the condyle in the fossa,

or create such a swelling or edema that the occlusion is impossible of correction. Such conditions should be known to the surgeon. For this reason, views of the temporomandibular joint should be had.

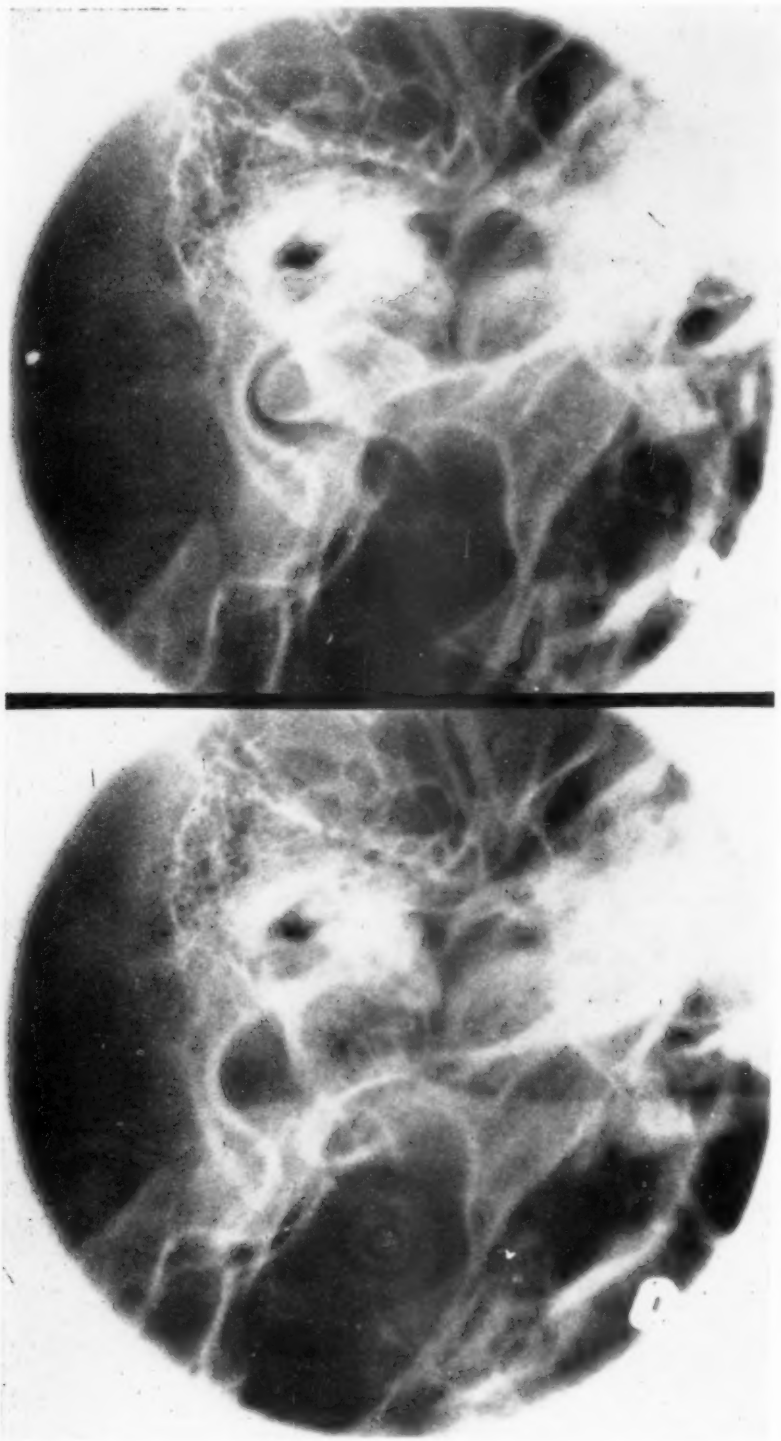


Fig. 16.

Reisner[4] has done well to standardize a temporomandibular technique, and the reader is respectfully referred to his work in this regard.

In the study of this joint it is usual to show it in both the open and closed position. For purposes of reproduction an angle board with a change tunnel will be particularly helpful, for then neither the patient nor the machine need be moved. If the board is calibrated, a reproduction can be made at a subsequent time.

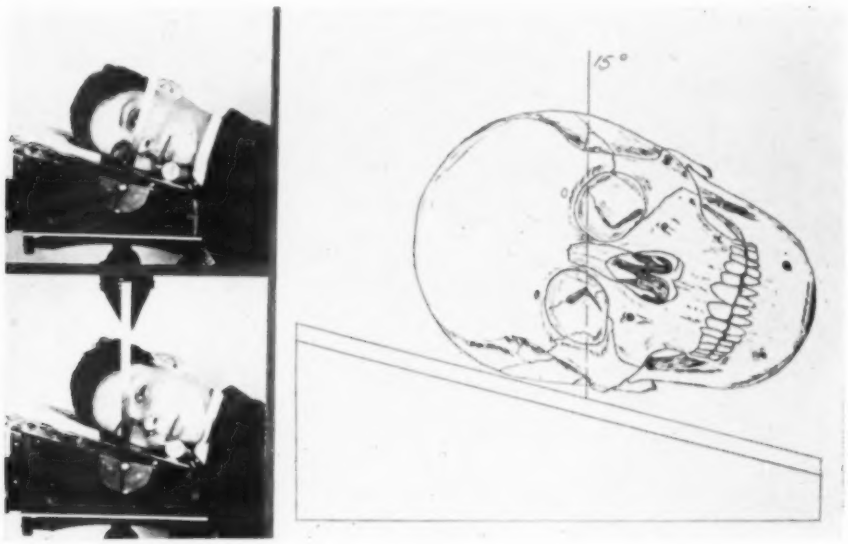


Fig. 17.

The essential in this technique is the absolute careful positioning of the patient in relation to the film (Fig. 17). The head should be so placed that the sagittal plane is parallel to the plane of the film and Reid's base line parallel to the lower border of the film. Reid's base line extends from the external auditory meatus to the inferior border of the orbit. This should place the joints directly over each other in a plane perpendicular to the film. The central ray enters the skull from the opposite side to that being radiographed and emerges at the site of the condyle under study. The point of entry is usually described as being 2 inches above the tragus of the ear, and the angulation plus 15 degrees to the film surface.

If one has an angle board, the same angulation exists, but with the board pictured, the point of entry will be determined by the path of the arms of the protractors. The fact is realized that persons' heads vary considerably in the lateral transverse dimension. While a standard angulation is readily agreed upon, the point of entry should vary in order that the central ray emerges at the condyle. The 15 degree angle board of self-manufacture has a marker placed at the center of the radiolucent face, which is interposed between the patient and the film. The protractors on the sides are in line with this marker. If the central ray is directed midway between the two arms and in the same plane as the arms, then the central ray must strike the film at the point of the marker. If the condyle is placed over the marker, then the central ray will likewise strike the condyle. For these films of the joint, intensifying screens, limiting diaphragm, or sinus cones are helpful for the best results. The accompanying illustrations (Fig. 16)

were exposed 1½ seconds with mid-speed screens. The target-film distance was 14 inches.

It has been my desire to write this paper in such a fashion as to include the general principles of extraoral technique so that it may appeal to the man with an interest in roentgenography as well as to the man who is interested in fracture work. I hope I have fulfilled the purpose "to present as simplified a technique as is possible with the average available dental x-ray unit."

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29 COMMONWEALTH AVENUE

ACUTE INFECTIONS OF DENTAL ORIGIN

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ACUTE infections involving the deeper structures of the neck are the most alarming and dreaded complications following dental disease, dental surgery, or injury to the lower jaw. The seriousness of these infections cannot be overestimated. Their control and treatment requires accurate knowledge of regional anatomy, understanding of pathology, and the utmost in surgical judgment, skill, and patience.

One of the most important etiological factors is the patients' lack of interest in their dental health or their failure to recognize the early symptoms of dental disease. The dental diseases of the lower jaw which predispose these occasionally fatal conditions are: periodontal inflammation, acute dentoalveolar abscess, erupting and partially erupted third molars (pericoronal infection), fractures, osteomyelitis, Vincent's infection, gingival disease, and general oral sepsis.

Because of their local manifestations, acute infections of dental origin are of primary interest to the qualified dental practitioner, who should not hesitate or fail to enlist the services of a surgeon in those cases which present symptoms of extension into the deeper structures. In this way the dentist shares his professional and legal responsibility with the consultant for the best interest of all.

The selection of the proper time for extraction or retention of a diseased tooth is debatable. One must bear in mind that any diseased tooth, either retained or extracted, is a potential factor in these serious infections, and often a precursor of osteomyelitis.

The excruciating pain associated with various diseases often influences the patient to urge or insist on the extraction of a tooth, and often the dentist gives in to the request, contrary to his best judgment, to his subsequent regret. Even in skillful hands and under ideal operating conditions, the most unprepossessing dental problem may become one of great postoperative concern. The removal of a tooth during an early inflammatory stage may abort a potential abscess, but the dangers of extension of the disease, except in rare cases, should prompt the dentist to postpone dental surgery and attempt palliative treatment until nature has had the opportunity to establish her barriers of defense.

It is not always the extraction of a tooth that causes the acute abscess of the face or neck, as these infections are frequently in progress and beyond local control when dental surgery is instituted.

Etiology.—The etiology is, of course, bacterial, the degree of the infection depending on the virulence of the organisms and the resistance of the patient. The chief cause is streptococci and staphylococci in their many variations, but one may also find several secondary invaders in the mouth and accessory sinuses, such as the *Bacillus fusiformis* and spirillum of Vincent's infection, colon bacilli, and pneumococci.

Signs and Symptoms.—Rapid and dramatic onset, disfigurement, and pain are the first symptoms to disturb the patient. These are followed by further extension of the inflammation until we find brawny, indurated swelling. This may occur in the midline or may be unilateral in the early stages; it is generally located near the primary site of dental disease or injury causing it. A unilateral swelling, however, may become bilateral as it progresses.

Trismus, resulting from the induration and fixation of the tissues, makes the movement of the mandible both painful and difficult. Often, the tongue is displaced upward and backward by pressure from beneath, which elevates the mucosa of the floor of the mouth to a level above that of the occlusal plane of the lower teeth. Breathing and swallowing may be difficult; the patient becomes weak and dehydrated from lack of food and fluid intake. The temperature is elevated and the pulse and respiration rate are increased.

Leucocytosis is always present. Blood cultures are frequently, but not always, negative. Fluctuation may not be evident because, if deep seated, the localized pus is confined within fascial limits.

An opening into the pulp chamber during the early stages may furnish sufficient drainage to prevent serious extension. This procedure, however, is often difficult, the tooth being too tender to endure the pressure and heat exerted by the dental drill. The results from opening the pulp chamber of a tooth, also, are often disappointing because of inadequate drainage and lack of gravitation. The local application of a hot raisin, or porous plaster may give relief by counterirritation or the promotion of local absorption.

The primary extension from dental disease into the supporting bone structure is by way of a proliferating inflammation of the periodontal membrane resulting from deep-seated dental caries, pulpitis, or gingival disease.

The membrane of the diseased tooth becomes engorged with blood, elevating the tooth in its socket. The tooth is sensitive to heat and pressure, and occasionally becomes loose. Under the confined pressure of inflammation, the periodontal membrane ruptures, thereby breaking down the first barrier of defense and liberating the products of inflammation into the cancellous portion of the mandible, resulting in osteitis. The suppuration generally continues in the path of least resistance until it penetrates the cortical layer of bone. During the subperiosteal stage the process becomes more painful until the periosteum breaks down. Following this, pain becomes less severe, and swelling in the soft tissue becomes apparent. This condition either subsides by local absorption or continues to extend into the deeper tissues of the neck.

The increase in the incidence of the unerupted or impacted lower third molar, or wisdom tooth, places this tooth as the most frequent source of acute infections. Its position is in close relation to the submaxillary and pharyngomaxillary areas. When impacted and extracted, the adjacent tissues are often subjected to serious trauma. The gingiva overlying a partially erupted lower third molar is continually exposed to the trauma of occlusion from the teeth above. Underneath the gingival flap a space or pocket is established for the retention of food remnants, which also serve as an ideal medium for bacterial growth.

Injuries, fractures, and osteomyelitis are all very closely related to each other and also to deep neck infections. Osteomyelitis may be one of the subse-

quent complications of any dental disease or injury, while a pathologic fracture of the mandible is a common complication of osteomyelitis.

A simple fracture of the mandible in a healthy mouth, if reduced promptly, is seldom followed by sepsis. A compound fracture, however, whether reduced promptly or delayed, will usually be followed by an osteomyelitis of varying degrees. The osteomyelitis may be limited to the area involved or it may extend to astonishing limits. Until such time as the osteomyelitis has fully resolved, there is an associated cellulitis of the adjacent soft tissues.

No standard can be established for the management of teeth in line of fracture, as each case offers its individual problem. A tooth extracted or lost by accident in line of fracture opens an avenue for bone infection through the tooth socket.

Cysts, either dentigerous or radicular, are usually chronic, walled-off areas of infection, which seldom result in acute infections of consequence unless opened or involved by an injury.

INFECTION OF THE FASCIAL PLANES

Regardless of the dental pathology, there are four distinct anatomic areas within the so-called fascial planes of the neck to be considered in acute infections of dental origin. They are the submental, the submaxillary, and the pharyngomaxillary spaces, and the carotid sheath.

Under normal conditions, these areas cannot be regarded as open spaces, but under the pressure of an invading suppurative process, they become true localities or compartments in which an abscess may form.

The Submental Area.—The submental area is located underneath the tongue and above the mylohyoid muscle. The anterior boundary is the symphysis of the mandible. It is bisected by the geniohyoid muscles. Infection in this area results from dental disease or injury located in the anterior part of the mandible. It is in this area that Ludwig, in 1836, first described and named Ludwig's angina, a disease which, according to early statistics, had a mortality rate of 20 to 40 per cent.

The Submaxillary Space.—Extending posteriorly and somewhat below the submental, lies the submaxillary space which often becomes involved from dental disease or injury in the molar region. This area is bounded laterally and above by the body of the mandible; its posterior landmark is the horn of the hyoid bone. At this extremity it is in close relation to the carotid sheath and the apex of the pharyngomaxillary area. Within this space will be found the submaxillary gland with the facial vein crossing it externally, and from beneath appears the external maxillary artery.

The Pharyngomaxillary Area.—The pharyngomaxillary area is triangular or cone-shaped with its apex at the horn of the hyoid bone and its base at the lower border of the skull at the jugular foramen. Its lateral boundaries are the internal pterygoid muscle, the inner surface of the ramus of the mandible, the parotid gland, and masseter muscle. The inner boundary is the superior constrictor muscle. This area is most frequently involved with pathology of the lower third molar or fracture at the angle of the mandible.

All these areas, particularly the latter two, extend downward into the carotid sheath on its way to the thoracic cage and posterior mediastinum. Dr. Mosher has termed these ramifications of the cervical fascia "The Lincoln Highway of the neck." To quote his description of neck infections: "Pus in the neck calls for the surgeon's best judgment and skill. Infection in this region generally kills by edema of the larynx and trachea. Such cases are soon over. There is, however, a more lingering type of infection in the neck. In this form of the disease, there is a thrombosis of the internal jugular vein or one of its branches, comparable in every way to a thrombosis of the lateral sinus which may follow an ear infection. This latter condition is well known to the profession, and surgeons are on the watch for it. Thrombosis of the jugular vein following infection in and around the neck is not so easily recognized. Many of these cases are classified in the death certificate as septicemia of unknown origin."

Dr. Furstenberg states: "Deep suppurative processes in the neck may attack and do great injury to the contents of the carotid sheath. Particularly is this true of the internal jugular vein, becoming the seat of a phlebitis or thrombophlebitis. If, during the course of a deep-seated inflammatory process in the neck beneath the sternocleidomastoid muscle, the patient exhibits chills and fever and demonstrates signs of sepsis, the presence of a phlebitis or thrombophlebitis would be suspected, and the vein exposed, ligated, and resected. Operation should not be delayed until a positive blood culture is obtained. It is a lifesaving measure to those in whom a cervical phlegmon has invaded the internal jugular vein."

It should be remembered, also, that the larger vessels of the neck may be eroded by the suppurative process, giving rise to a fatal hemorrhage. Several small hemorrhages usually precede the final and fatal flow of blood. The recognition and anticipation of such an accident calls for another surgical measure, namely, ligation of the common carotid artery.

Treatment of Fascial Abscesses.—The important factors in treatment are: early diagnosis, prompt incision and drainage, and the accurate recognition of the potential anatomic areas which may be involved with a deep-seated abscess.

In those cases where the infection has not passed beyond its primary barriers into the deeper structures, it is the usual procedure to institute oral irrigation with hot saline and the external application of dry heat. If the condition continues to be localized intraorally, a point of fluctuation develops within twenty-four or forty-eight hours. Drainage can often be accomplished by an intraoral incision in the mucosa and a blunt dissection carried to the depth of the abscess. This should be supplemented with the insertion of a rubber-dam or gauze wick for the maintenance of drainage. Heliotherapy alone, or combined with short-wave x-ray therapy, applied to the neck, are of benefit during the early symptoms.

When the infection has followed the fascial plane of the mylohyoid muscle to the deeper structures with fluctuation and pointing, external incision over the maximum point of swelling and tenderness, and at the lowest point of drainage will be adequate. Through-and-through drainage into the mouth often is unnecessary and presents the added risk of further contamination of

the condition by the organisms of the mouth and the occasional aspiration of the septic by-products into the lungs.

Incision and drainage of the submental area can generally be accomplished by an external incision in midline carried through the mylohyoid muscle to the depth of the abscess. When the abscess is localized beneath the tip of the tongue, an intraoral approach will occasionally be sufficient.

Involvement of the submaxillary and pharyngomaxillary areas is often confusing because of the lack of fluctuation and pointing following continued external poulticing. With obvious clinical and laboratory findings indicating the necessity for incision and drainage, these cases are often operated upon with disappointing and unsatisfactory results, because of an inadequate search of the potential anatomic areas for a deep-seated abscess. In such an infection, therefore, a more radical procedure is indicated, namely, the Mosher T-shaped incision, which consists of a horizontal incision carried from the mental region posteriorly and along the lower border of the mandible, to a point where it bisects a vertical incision directed downward from a point opposite the condyloid process to the neck. The two flaps which form the right angle of the two incisions, when turned upward and downward respectively, offer a complete approach into both areas. With the reflection of the upper flap, the submaxillary gland is exposed and turned upward out of its bed in the submaxillary area, exposing the facial vein which should be ligated and resected. It also exposes and raises the external maxillary artery, which should be resected. The hypoglossal nerve will appear just above the anterior belly of the digastric muscle. This approach allows the surgeon to follow with his finger the carotid sheath upward or downward as his judgment indicates.

His upward approach allows a thorough search of the pharyngomaxillary space, the lateral surface of the tonsil, the end of the styloid process; and, further directing his finger upward and laterally, he is able to reach the base of the skull.

With the knowledge that neck infections resulting from oral pathology are of a mixed type, and the chief invaders are the beta hemolytic streptococci, various strains of staphylococci, and the spirillum of Vincent, it seems reasonable and appropriate that sulfanilamide and neoarsphenamine medication be added to the surgical and supportive treatment.

Dr. Arthur Alden, of St. Louis, published, in 1936 and 1939, two articles regarding the bacterial studies of a series of fifty-eight cases. Smears and cultures from the original lesion, and from pus released at the time of operation were studied. The spirillum of Vincent's infection was found to be the predominating organism and the principal invader in fifty-two of the total cases. In sixteen cases it was the only organism reported. In thirty cases it was found in symbiosis with a streptococcus; in three, with a staphylococcus; and with streptococcus and colon bacillus in two cases. Six cases were not cultured.

Recognizing the organisms of Vincent as the most probable and important factor in the invasion of the deep structures of the neck, he instituted a routine procedure of intravenous administration of neoarsphenamine, all patients receiving one or more doses, the first dose being given immediately on admission to the hospital. He reports that the results were, many times, spec-

tacular, and, on several occasions, the rapid spread of a diffuse cellulitis had been checked, localization beginning within twenty-four or forty-eight hours following administration of the drug.

Since the publication of his first article in 1936, I have instituted a similar routine on nearly all my cases, though in more recent times chemotherapy with one of the sulfonamides is favored in many instances.

All of the cases reported by Dr. Alden were postoperative infections being treated as such. The majority of my cases have been approached from the prophylactic point of view by the local treatment of Vincent's infection previous to dental surgery, paying particular attention to partially erupted lower third molars and fractures of the mandible. Following smears, a dark-field study for Vincent's infection was carried out at least twenty-four hours previous to surgery. In those cases where trismus was present and the infection had already extended into the deeper structures of the neck, intravenous neoarsphenamine was administered. Comparative statistics are not of accurate value, but it seems to have been my experience that postoperative complications have been minimized.

Postoperative care should consist of: bed rest with bed elevated at head, hot saline irrigation every two hours, flaxseed poulticing every two or three hours, intravenous 5 per cent glucose and saline, liquid diet, forced fluids, and a tracheotomy set at hand.

The choice of anesthetic should receive careful consideration as it frequently offers an added risk, particularly where trismus is present and there is an impediment of the normal airways. A peritonsillar abscess is a common complication and cannot always be detected because of the patient's inability to open the mouth. Surgical manipulation of the external tissues under general anesthesia may rupture the tonsillar tissue liberating a large amount of pus into the throat, which may thereby be aspirated into the lungs resulting in a serious or fatal respiratory infection.

Local anesthesia, whenever possible, should be accepted as the choice, particularly in a patient whose normal airway is mechanically handicapped. Any anesthetic which interferes with the cough reflex must be considered as a danger. Anesthetic deaths from asphyxia are occasionally reported during the administration of a general anesthetic.

CONCLUSIONS

1. Acute infections of the deeper structures of the neck are a common and serious complication of dental origin.

2. The patients' interest in their dental health and the recognition of the early symptoms of dental disease are important prophylactic factors.

3. Incision and drainage is indicated promptly when the infection becomes localized.

4. Four anatomic areas should be considered as potential localities for deep-seated abscess formation.

5. Surgery and supportive treatment should be supplemented by sulfanilamide or neoarsphenamine therapy or both, as indicated by studies of the bacteriology.

29 Bay State Road

A NEW METHOD OF INTERMAXILLARY FIXATION FOR JAW FRACTURES IN PATIENTS WEARING ARTIFICIAL DENTURES

KURT H. THOMA, D.M.D., BOSTON, MASS.

INTERMAXILLARY fixation by means of wire ligatures fastened around an adequate number of teeth in the upper and lower jaw is probably still the simplest and most nearly foolproof method for reduction of new simple fractures of the mandible. The fastening together of the wires on the opposing teeth brings the dentures into occlusion, at the same time reducing the fracture. As a rule, this method produces an anatomically perfect result. In older fractures, when fibrous union prevents easy reduction by manipulation, or when trismus of the elevator muscles prevents the placing of the posterior fragment into normal position, elastic traction can be applied between the upper and lower jaw. Traction yields excellent results in twenty-four to forty-eight hours, and has many applications in the orthopedic treatment of both maxillary and mandibular fractures.

Cases are frequently encountered in which intermaxillary fixation and intermaxillary traction cannot be applied. Many of these cases can be successfully treated today with skeletal fixation. Various methods are available and have been described by Griffin (1941), Thoma (1942), and Waldron (1943).

A patient came under my care some weeks ago with a fracture which could be treated neither by intermaxillary wiring nor by skeletal fixation. Not only had he sustained an unusual fracture, but he had, in addition, an edentulous upper jaw. Fortunately, however, he had been wearing a well-constructed artificial denture. The method of treatment is described in the following case report.

CASE REPORT

The patient, a 28-year-old white man, was referred to me on April 29, 1943, by Dr. Henry C. Marble, because of pain in the region of the left temporomandibular joint. He had been admitted to the Baker Memorial Hospital the day before because of lacerations of the face and fracture of the jaw.

Past History.—The patient has suffered from migraine headaches all his life, although these have been less frequent in the past few years. His tonsils and adenoids were removed at the age of 8 years, and his appendix at the age of 13 years. About twelve years ago, the patient fell and twisted his right knee, which has been unsteady ever since. About ten years ago, he had a broken nose; since then, the right nostril has been partially obstructed. An automobile accident in 1933 resulted in no known injury. In 1939 the patient fell from a horse, and the same year was in another automobile accident.

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Although no injury was sustained, the patient was "pretty well shaken up." Finally, he has suffered from "rheumatism" of both legs for the past four years, without any known sequelae.

Present Illness.—The patient is a fire extinguisher loader. Two days before I saw him, a fire extinguisher, which he was repairing and filling, exploded, striking him in the face and causing him to fall to the floor. He was not sure whether or not he lost consciousness. The patient continued to work after the accident took place, and then drove himself to the hospital.

There was slight swelling over the left mandibular joint, and evidence of bleeding from a painful wound just anterior to the tragus of the left ear. Pain in the joint could be elicited on opening and closing of the teeth and especially on lateral motion of the jaw.

Fig. 1.—Intracapsular fracture of condyle extending down into ramus.

Physical Examination.—The patient was in good health. The blood pressure was 100/64, temperature, 98.8° F., pulse rate, 72, and respiration, 20. Marked deviation of the nasal septum to the right was noted, with partial obstruction of the nasal canal. The upper jaw was edentulous, but the patient wore a well-made artificial denture. The lower posterior teeth were missing, and around the eight remaining mandibular teeth evidence of gingivitis was present. There were no substitutes for the missing teeth in the lower jaw. The patient had a moderate amount of trismus of the elevator muscles at the right, with tenderness over the mandibular joint and the middle of the horizontal ramus. A neurological examination showed that he was symptom-free so far as the head was concerned. The reflexes were normal throughout. There was no tender point on the scalp and no swelling on the head.

Roentgen Examination.—X-ray films of the skull were negative except for a vertical line of diminished density in the temporal bone, believed to be a vascular marking. A lateral stereogram, taken of the skull, showed no other abnormality in the temporal region. A fracture was found through the head

of the condyle extending obliquely downward in the ramus to the angle of the jaw (Fig. 1).

Diagnosis.—Concussion of the brain and fracture of the condyle and ramus of the mandible.

Because the condyle was split in half sagittally (Fig. 2), this fracture differed from fractures in the subcondylar area. First, it was intracapsular and not extracapsular as are most fractures in this location. Second, there was no overriding of the fragments, and, therefore, no vertical shortening of the ramus, which is very frequently seen in horizontal or oblique fractures through the bone attaching the condyle to the ramus.

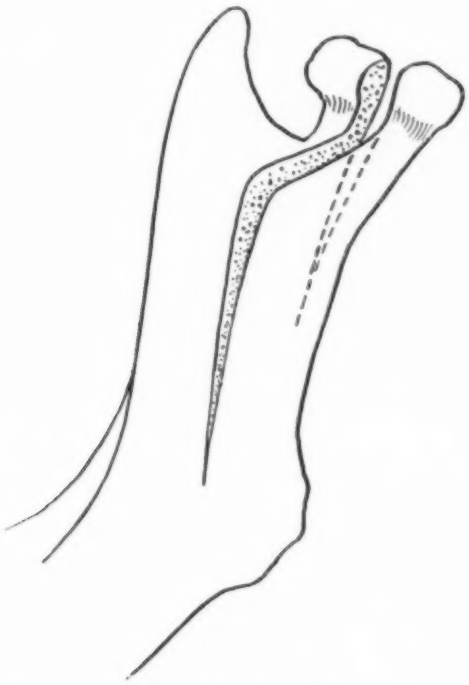

Fig. 2.—Schematic drawing to visualize fracture shown in x-ray, Fig. 1.

Treatment.—Complete stabilization of the mandible was indicated in this case to prevent motion in the joint during the healing period. The wiring of the upper artificial denture to the lower anterior teeth with a Barton or a four-tailed bandage for support was deemed ineffective because of the amount of motion any bandage allows, especially a day or so after it has been applied. In addition, there is generally considerable accumulation of food under the denture, due to this constant displacement, which results in exceedingly poor hygienic condition of the palatal mucosa. Stimulated by the good results obtained by the internal wiring fixation advocated for facial fractures by Adams (1943), I devised the procedure described below.

Operation.—With intravenous pentothal sodium anesthesia, an arch wire was first attached to the labial surface of the lower teeth with stainless steel wire. An incision was then made in the muco-labial fold below the upper lip. In order to locate the place where the incision should be made, we palpated the outline of the nasal fossa. Proceeding from the nasal spine in the median

line laterally, we read the angle where the bony margin curved upward. Peripherally to this curve, a short incision was made in an oblique direction. This incision was carried through the periosteum, which was reflected up by means of a periosteal elevator until the margin of the nasal fossa was exposed.

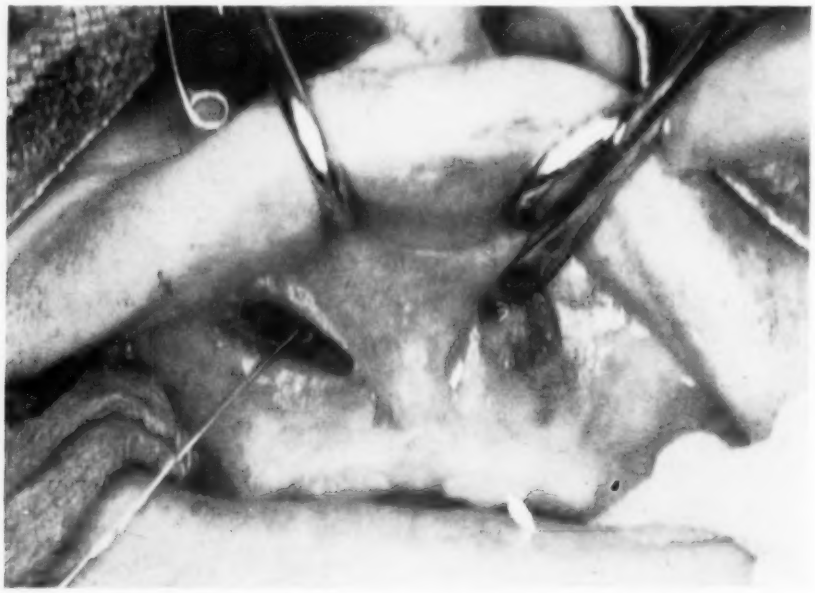

Fig. 3.—Wire inserted on one side; on the other side the hole has just been drilled.

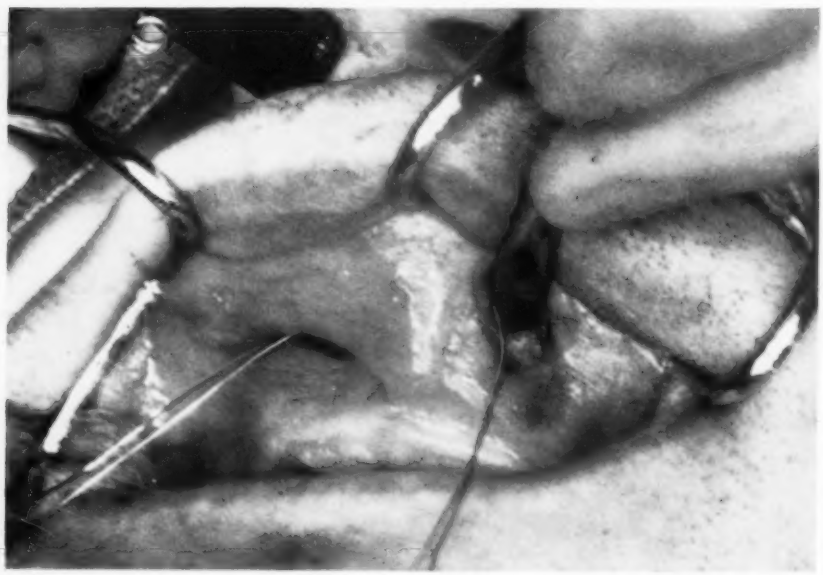

Fig. 4.—The wire has been inserted on the other side.

The mucoperiosteum of the nasal cavity was next elevated from the inner surface and retracted, and a hole was drilled from without, by means of a small bur, through the thin process of bone. The hole was made on the upper part of the curve, where the nasal process of the maxilla is composed of cortical

bone (Fig. 7), and not in the horizontal edge, where the bone is cancellous, presenting favorable conditions for osteomyelitis (Fig. 3).

A stainless steel wire (gauge 0.22), sterilized with the instruments, was pushed through the hole from the outside and pulled back by means of a hook

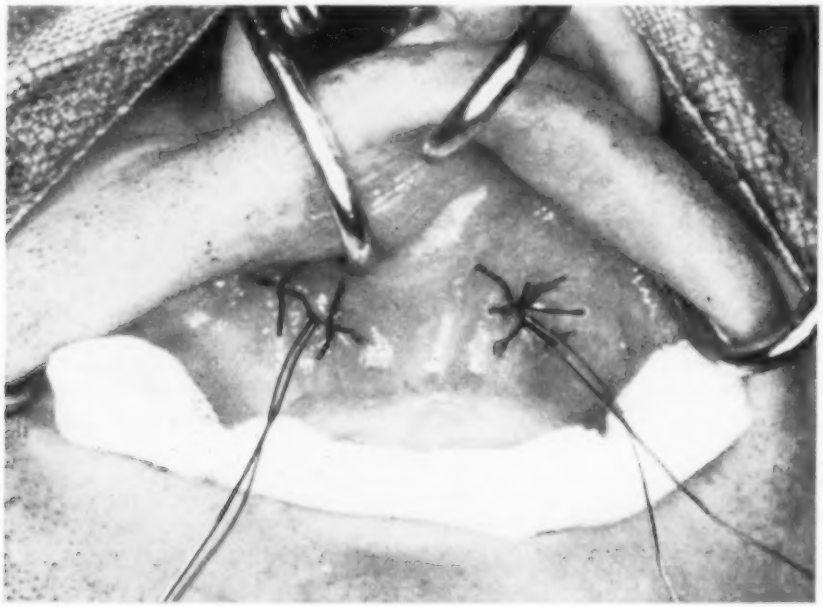

Fig. 5.—Incisions closed with silk sutures.

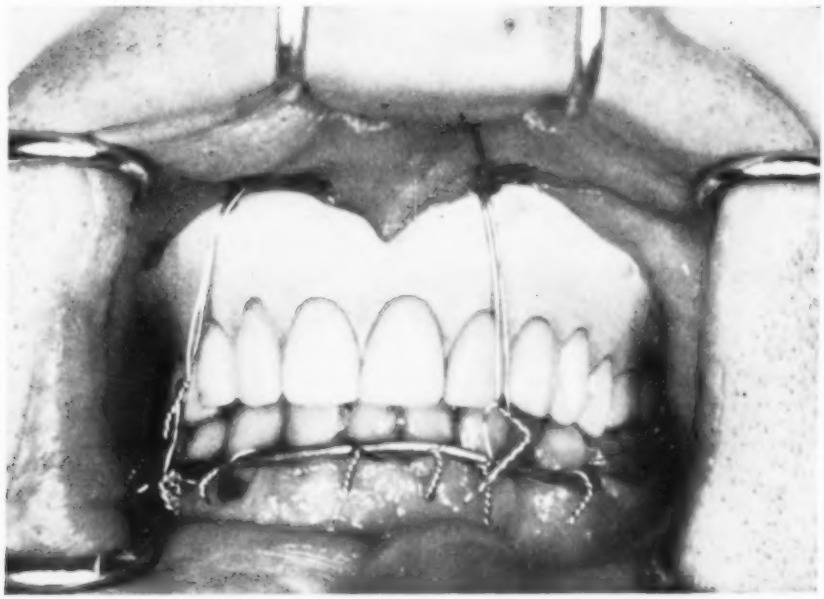

Fig. 6.—Denture inserted and nasal wires attached to arch wire in mandible.

or narrow pliers, while the nasal mucosa was protected with a solid retractor so that it would not be pierced by the wire. The wire was then looped, pulled down, and twisted (Fig. 4). After the procedure was repeated on the other

side, the incisions were closed with silk suture (Fig. 5). The artificial denture was inserted next. It was necessary to observe whether the wire came out of the tissue over the margin of the flange, since in cases where the latter is too high, a notch must be cut where the wire goes. In this instance, the denture fitted exactly, so the wires were drawn down over it and were firmly attached to the arch wire at the mandible (Fig. 6). The wires drawn from the nose to the mandible produced rigid intermaxillary fixation. Not only immediately after the operation, but during the five weeks following, the jaw was completely immobilized.

Aftercare.—The patient had practically no local reaction from the operation and suffered no pain. The aftercare consisted of bed rest for two weeks, not because of the jaw fracture, but because of the severe trauma caused by the accident. If there had been no complications, the patient could have been discharged as soon as he had recovered from the operation, and because no external bandages were needed, could have pursued his regular work without being conspicuous.

The patient was put on a liquid diet, as are all fracture cases treated by intermaxillary fixation. The diet in all such cases should contain the right number of calories so as to avoid loss of weight. The food may be taken by means of a suction tube, though some patients prefer a small teapot with a nozzle. Others can manage a cup or a glass.

After discharge from the hospital, the patient was seen once or twice a week for irrigation of the mouth by means of a power spray. The sutures were removed after a week.

After the fifth week of treatment the wires were cut away from the mandibular bone, the arch wire was removed from the lower teeth, and the upper denture was taken out. The denture was absolutely clean at the surface covering the palate, and the oral mucosa was in excellent condition. After carefully spraying the mouth with a 1:5,000 solution of metaphen, and applying tincture of metaphen to the twisted wires inserted into the nasal margin, and to the area where the wires entered the mucosa, I took hold of one wire with a hemostat. I then clipped one of the strands with a pair of wire scissors as near the bone as possible, and drew the other out by a quick pull. Because of the rapidity with which the wires were removed, no anesthesia was necessary; in very sensitive patients, however, local anesthesia, or nitrous oxide and oxygen might be employed.

The result of this treatment was very gratifying. The patient was given exercises for both vertical and lateral motion to limber up the muscles of the jaw. After ten days his jaw functioned normally and without pain in the joint.

COMMENT

The fracture sustained in this case was unusual. The treatment used, however, would be equally applicable to fractures through the neck of the condyle, except that in the latter, the overriding of the fragments, which is due to muscle spasm, would have to be overcome. This can be accomplished by constructing either a partial lower denture, or a similar appliance with bite blocks instead of teeth, for the purpose of pulling down the ramus against the upward pull of the masseter, temporal, and internal pterygoid muscles.

Fig. 7.—Specimen showing rigid nasomandibular fixation.

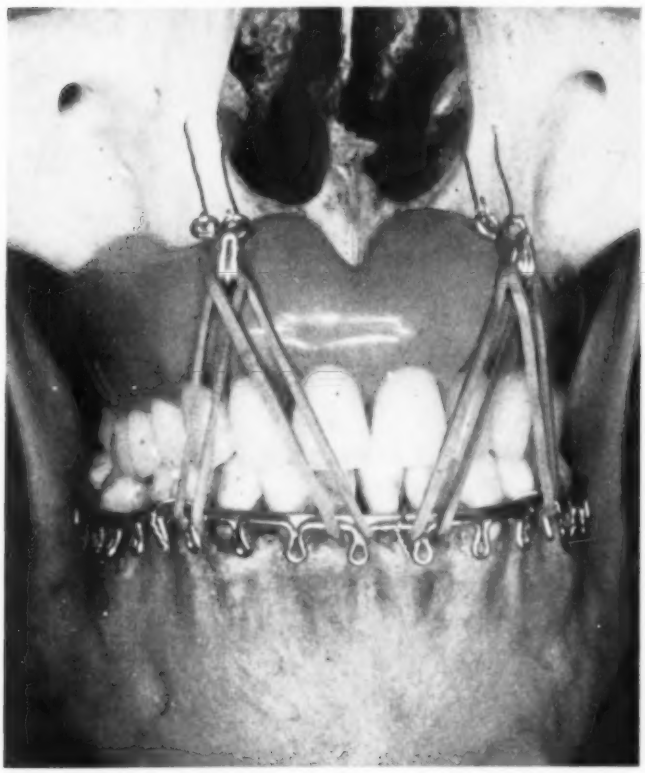

Fig. 8.—Specimen showing elastic traction.

The procedure can be used for patients wearing a full artificial denture in the upper jaw, or for those wearing a partial denture supplying the anterior teeth. It can be used both for rigid fixation and for elastic traction.

Rigid Fixation.—This procedure, illustrated by the case reported and shown in specimen Fig. 7, is applicable in fractures of the condyle or the subcondylar region of the ramus as well as in other fractures of the mandible without displacement. If the patient has no posterior teeth in the mandible, a partial lower denture may have to be inserted to prevent shortening of the ramus. If the posterior fragment is displaced, direct wiring may have to be resorted to in order to counteract the muscle pull.

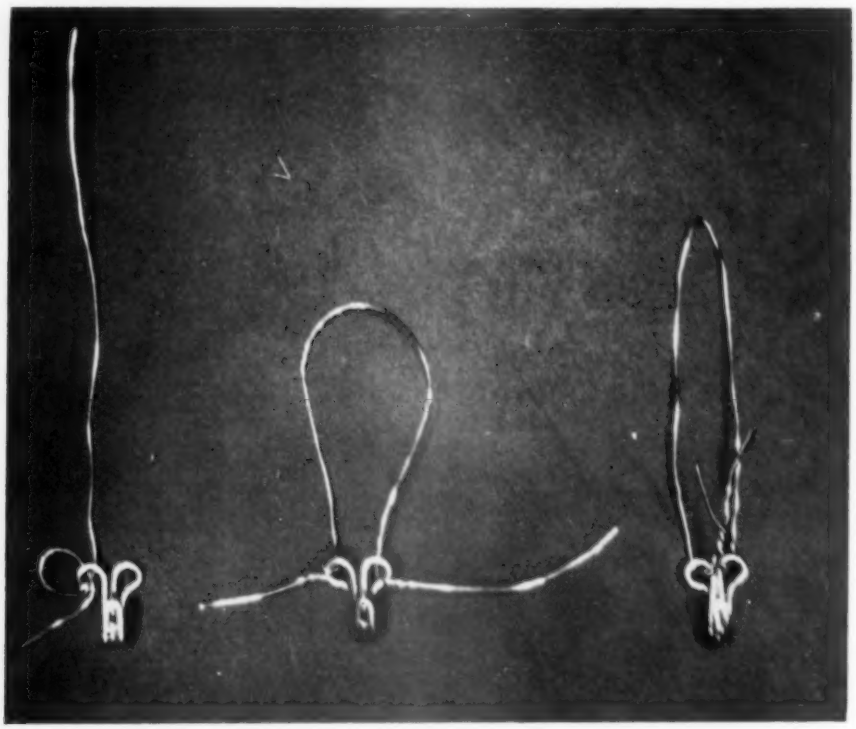

Fig. 9.—Attachment of hook to nasal wire.

Elastic Traction.—The method described may also be used in case of open bite such as occurs in horizontal fracture of the maxilla, or bilateral condylar fractures. In such cases the posterior teeth of the artificial denture in the upper jaw form a fulcrum against the posterior molars in the mandible (or suitable substitutes as described above) so that traction applied in the front of the arches closes the bite either by bringing the upper jaw down (in maxillary fractures) or by pulling the ramus down (in condylar fractures with overriding). The nasal wires are inserted in the same way as for rigid fixation cases. However, they are not fastened to the mandibular arch wire (which in this case should be made of a piece of Jelenko or Winter splint). Instead, a small hook (such as that in the hook and eye used on women's garments) is attached to the nasal wire as near the end of the flange as possible (Fig. 8). The attachment is made by passing one strand of the wire through the left

eyelet twice and the other through the right eyelet of the hook. The two wires are twisted together as shown in Fig. 9. A strong elastic band is then passed over the hook and attached to one of the loops on the mandibular arch wire. If only an ordinary arch wire is available, "buttons" should be formed with the twisted wire at suitable places.

If the intermaxillary distance is too small to apply efficient traction with elastic bands attached to each side, one strong band may be passed over all four attachments. The nasal wires should not be cut short at the hook, but should be of sufficient length so that they can be attached to the mandibular arch wire later when traction has closed the bite, which takes place in twenty-four to forty-eight hours, depending on how old the fracture is. Until the nasal wires are used to transform elastic traction into rigid fixation, they may be twisted around the arch wire so that they will not hurt the patient.

The method described has several advantages: It is easily applied. It does not employ the support of external bandages, which, sometimes, prevent the ambulatory patient from pursuing his normal way of life, as well as from combing his hair, shaving, and washing his face, and which are never very satisfactory since they allow too much movement of the jaw. The patient is not uncomfortable and can eat as well as with the ordinary type of intermaxillary fixation employed when teeth are present in both the upper and lower jaw.

SUMMARY

A new method of intermaxillary fixation of jaw fractures for use in partly edentulous patients is described. A report is presented of a case in which the method of treatment was used with gratifying results, and the means of application of the method to other types of jaw fractures is explained.

The advantages of this method are ease of execution, effectiveness, and minimum discomfort and inconvenience for the patient.

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53 Bay State Road

FISSURAL CYSTS OF THE MEDIAN PALATINE SUTURE

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THE etiology of fissural cysts of the median palatine suture can be more fully understood if we review the embryologic development of the palate. In the early growth of the fetus, the oral cavity is in open communication with the nasal cavity, no palate having yet been formed. The palate is made by an outgrowth from the two maxillary processes and the premaxilla from the globular processes. Within these, bone is layed down producing the hard palate which joins in the median line, leaving a suture that extends between the central incisor teeth (Fig. 1*A*, *B*, and *C*). When the palatal parts unite, the surrounding epithelium usually disappears, and a solid junction is brought about. During the union of these parts, epithelial remnants may remain anywhere along the median palatine suture, and in later life, if stimulated, may give rise to cysts.

These cysts can be referred to as median cysts, and are formed in this suture posterior to the incisive canal. The nasopalatine ducts, which are communications between the nasal cavity and the oral cavity, also develop during embryonic life. In humans they usually become obliterated in the first few years of postnatal life. In some individuals, however, they may persist, opening as two small slits on either side of the papilla palatina. These ducts are lined with mucous glands which, if they secrete mucin, cause occlusion of the opening of the ducts, and give rise to a retention cyst in the incisive canal. Nasopalatine and epithelial remnants in the incisive canal can also cause cysts. Such cysts we classify as *incisive canal cysts* (Fig. 2).

DIAGNOSIS OF CYSTS OF THE MEDIAN PALATINE SUTURE

Median cysts may be found in dentulous or edentulous mouths. They occur anywhere in the median palatine suture, posterior to the incisive canal, and may grow to considerable size, which can be easily demonstrated by x-ray (Fig. 3). They are manifested by a swelling on the palate, which, when palpated, has typical cystic fluctuation. In other instances, when pressure is felt on the floor of the nose, the cyst produces a nasal swelling which interferes with breathing.

Incisive canal cysts occur in the region of the incisive canal and can be differentiated from cysts of the palatine papilla by roentgen examination. However, the x-ray of incisive canal cysts is not always constant. The majority of these cysts are situated in the midline, extending laterally in a symmetrical manner (Fig. 4). When the cyst extends to only one side of the median line, its origin is probably from a single nasopalatine duct. In rare instances, one may find on the roentgenogram a heart-shaped area, which is a double cyst caused by involvement of both nasopalatine ducts. The incisive canal cyst should be differentiated from the radicular cyst. This is often

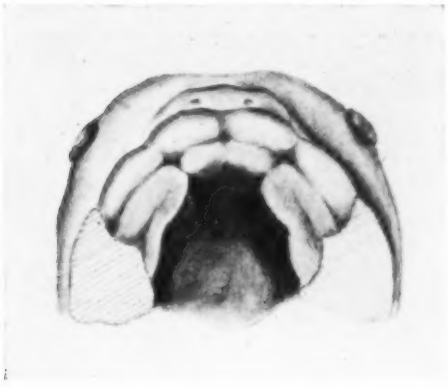

Fig. 1*A*.—Diagram of embryo showing globular processes uniting with maxillary processes.

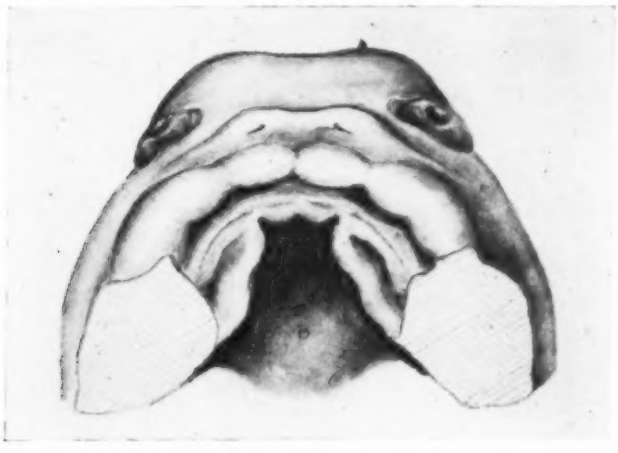

Fig. 1*B*.—Diagram of embryo at beginning of palatal process formation.

Fig. 1*C*.—Diagram of embryo showing palatal processes about to unite.

Fig. 2.—Frontal section through the anterior part of the maxilla showing an incisive canal cyst filled with cholesterin crystals. Section also shows alveolar abscess at apex of retained root.

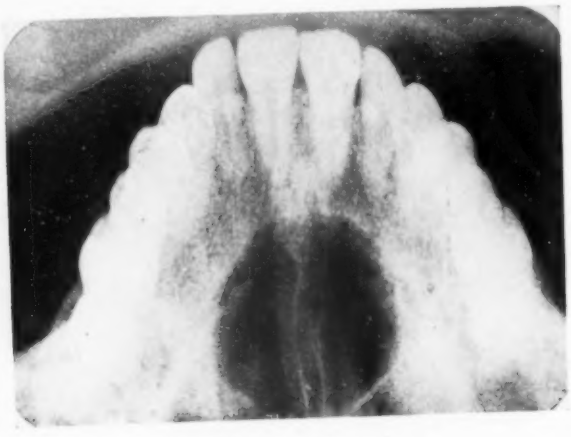

Fig. 3.—Median cyst.

A. *B.*

Fig. 4.—*A*, Incisive canal cyst. *B*, Shows probe inserted from papilla palatina into cyst.

difficult because the apices of the incisor teeth in the small intraoral film seem to protrude into the cystic area. A mistaken diagnosis may lead to devitalization and possible loss of the incisor teeth. A large intraoral film, with the use of a radiopaque solution injected into the cyst will facilitate diagnosis. After the mucosa is first anesthetized, these cysts may be injected by a submucosal injection of novocain suprarenin. Push through the thin wall of bone encasing the cyst with a syringe mounted by a heavy, sharp needle; aspirate the cystic fluid; and replace the syringe, without withdrawing the needle, by one filled with lipiodol, previously warmed. Inject the lipiodol, and, after withdrawing the needle, place a piece of cotton over the puncture and seal with collodion. The x-ray should be taken immediately, before the lipiodol can escape. In some instances when a great deal of force is used, the lipiodol may be forced through the nasal end of the nasopalatine canal into the nose (Fig. 5). Incisive canal cysts, like odontogenic cysts, are surrounded by a layer of cortical bone, which, in the x-ray picture, appears as a light line around the cystic area.

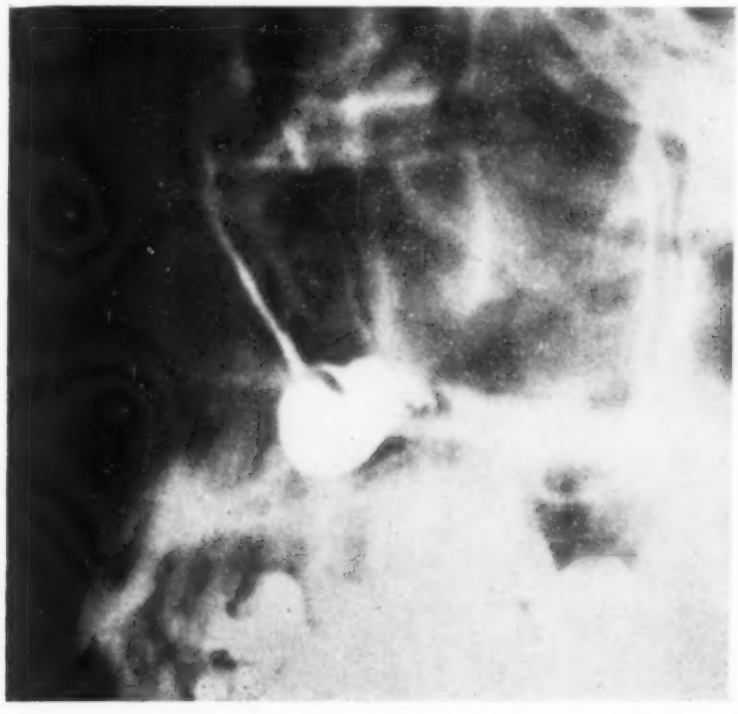

Fig. 5.—Showing lipiodol solution forced through the nasopalatine canal.

HISTOPATHOLOGY OF FISSURAL CYSTS OF THE MEDIAN PALATINE SUTURE

Median cysts, on microscopic examination, show a connective tissue sac which varies in thickness according to its size. If it is large, the sac has a very thin membrane made up of loosely connected collagen fibers and is usually lined with stratified squamous epithelium (Fig. 6). Smaller cysts have a thicker wall, contain less fluid, and are also lined with stratified squamous epithelium. These cyst sacs do not contain mucous glands, thereby being differentiated from incisive canal cysts.

Fig. 6.—Microscopic section of membrane from median cyst showing bundles of collagen fibers and lumen lined with stratified squamous epithelium. Same case as Fig. 3.

Fig. 7.—X-ray showing large incisive canal cyst. With absence of symptoms, this can be assumed to be a normal condition.

Incisive canal cysts generally contain a thick connective tissue membrane in which is found groups of mucous glands, or tiny accessory cysts with mucoid contents as pointed out by Stafne and his associates. The epithelium lining

Fig. 8*A*.—Incisive canal cyst.

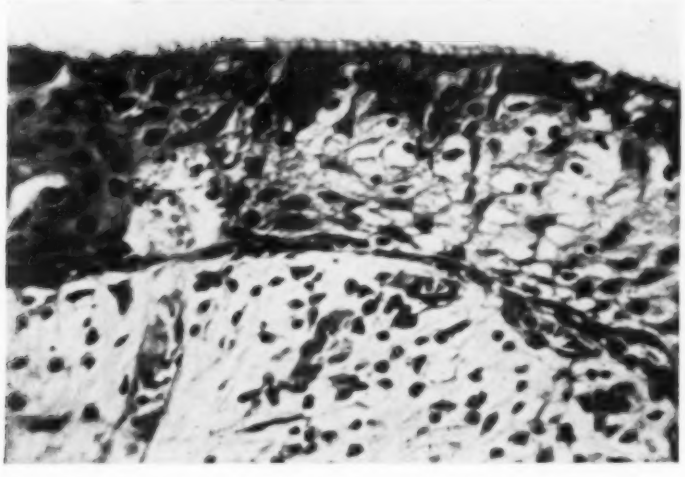

Fig. 8*B*.—Photomicrograph showing ciliated columnar epithelium with which lumen of cyst sac was lined.

the lumen varies. In cysts arising from the oral part of the nasopalatine duct there is squamous or transitional epithelium, whereas, in cysts derived from the nasal portion, ciliated columnar epithelium is found.

DISCUSSION

There has been considerable confusion in the nomenclature of the cysts found in the median palatine suture, so that incisive canal cysts have been

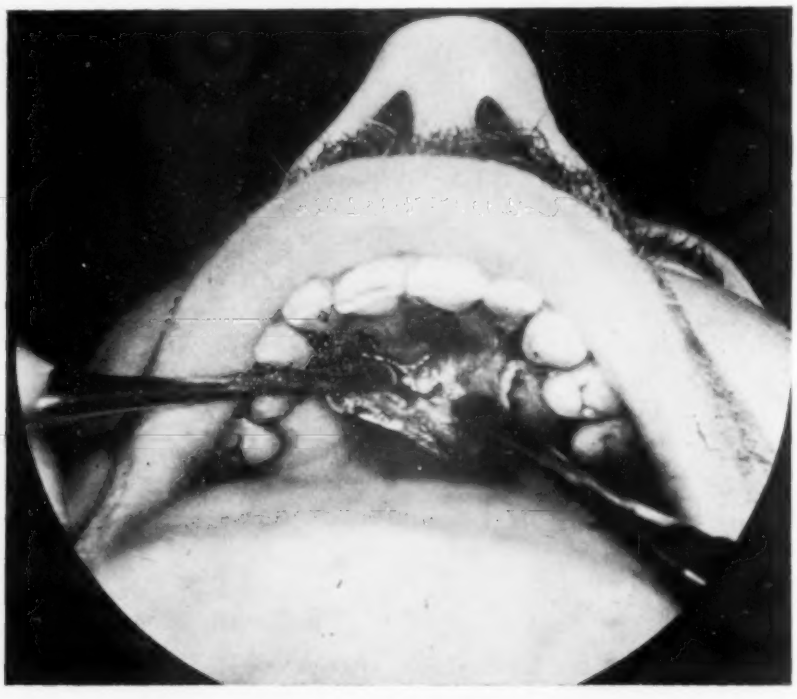

Fig. 8*C*.—Incisive canal after removal of cyst.

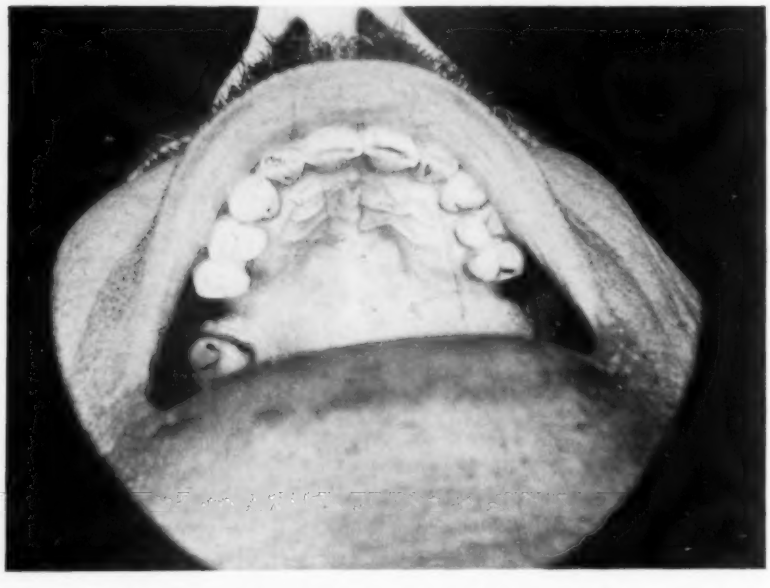

Fig. 8*D*.—Same patient as above, one year later, showing complete healing of soft tissue in region of incisive canal.

called median cysts and vice versa. It is important to correctly classify these cysts according to their etiology as well as their histopathology. To aid in accurately labeling them the following description of each should be noted:

I. Median Cysts.—The median cysts arise from enclaved epithelium within the palatine suture and are not of odontogenic origin. They are found anywhere along the median palatine suture posterior to the incisive canal.

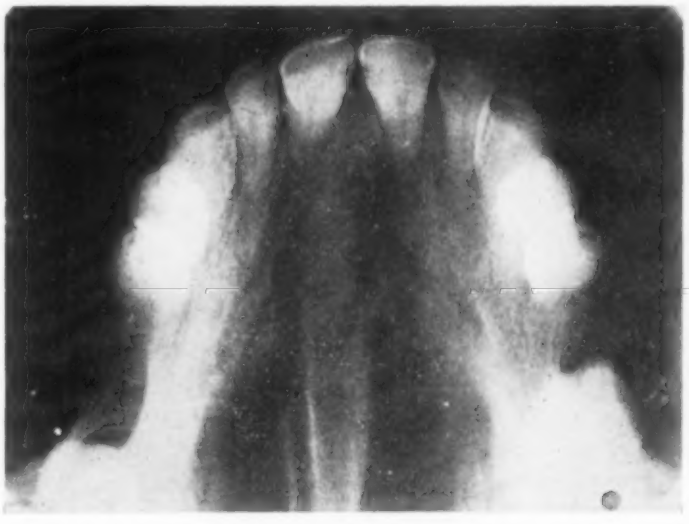

Fig. 8*E*.—Same patient as above, one year after operation, showing partial filling of cyst cavity with bone.

Fig. 8*F*.—Same patient as above, eighteen months later, showing further disposition of bone almost filling the cyst cavity.

They may grow to considerable size, thereby giving symptoms of swelling on the palate, or they may interfere with breathing by pressure on the floor of the nose. Radiographically they may be differentiated from the incisive canal

by their anatomic location. The cyst membrane, when enucleated, shows microscopically a connective tissue sac, thick or thin depending on the size of the cyst, as explained above. The sac is lined with stratified squamous epithelium.

II. Incisive Canal Cysts.—These cysts are formed in the incisive canal from the nasopalatine ducts or epithelial remnants within the incisive foramen. Occasionally, a large incisive canal may be demonstrated by x-ray, and, with the absence of all symptoms, this may be assumed to be a normal condition (Fig. 7). Incisive canal cysts are not of odontogenic origin and may be found in the edentulous as well as the dentulous mouth. They may grow to considerable size. The diagnosis of incisive canal cysts can be established by the anatomic position by means of a roentgenogram. Histologically the cyst membrane may be differentiated from that of the median cyst. It usually has a thick wall of connective tissue within which we may find groups of mucous glands and small accessory cysts with mucoid contents. The epithelium lining the lumen varies; we may find stratified squamous epithelium in cysts arising from the oral part of the incisive canal, or ciliated columnar epithelium in those arising from a cord extending down from the nasal cavity.

TREATMENT

Once a definite diagnosis of either a median or incisive canal cysts has been established, the treatment is surgical removal of all the contents of the cyst. It is important to remember that teeth should not be removed even though in the x-ray their apices seem to protrude into the cyst cavity. We have had the opportunity to observe the healing process in two incisive canal cysts and find that the cavity is gradually filled with bone (Fig. 8*A*, *B*, *C*, *D*, *E*, and *F*).

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520 BEACON STREET

Case Reports

CASE NO. 83

MULTIPLE CYSTS OF JAWS

I. H. L. Shilefstein, M.D., D.M.D., Brooklyn, N. Y.

THE patient, a 25-year-old white woman, born in the United States, came to the office on March 19, 1942, with the following complaint: "One month ago I noticed a slight swelling behind the last molar of the lower left jaw. Then there was a thin discharge, and the swelling disappeared. I visited my dentist, who took two x-rays and found a cyst."

General Examination.—The patient was a healthy young female with no systemic abnormalities. Blood and urine were within normal limits.

Oral Examination.—There was a swelling behind the third molar in the left mandible. Palpation revealed the absence of bone from the third molar upward for one inch on the anterior aspect of the ramus. Fluctuation was present. Externally, there was very slight swelling and lymph nodes were not palpable.

Roentgen Examination.—The x-ray showed a large cyst involving the second and third molars, the angle and greater part of the ramus (Fig. 1).

Diagnosis of radicular cyst was made.

Operation.—Under local anesthesia the second and third molars and the cyst were removed in one mass. The cystic membrane was very thin. The postoperative course was uneventful, and healing was by primary intention.

Pathologic Examination (Lutheran Hospital, Brooklyn).—Macroscopic description: The specimen consists of an irregular saclike structure, 4 by 2.5 by 1 cm. The wall is fibrous in nature and averages 2 mm. in thickness. Microscopic examination shows stratified squamous epithelium with adjacent inflammatory fibrous tissue. There are some ulceration and multiple foci of chronic inflammatory cellular infiltration. There is no evidence of malignant neoplasm nor specific inflammation. Diagnosis: Radicular cyst (Fig. 2).

Subsequent to the removal of the cyst, and in answer to a question about the missing upper left anterior teeth, the patient stated that a cyst and the first five teeth in this area were removed in September, 1940. She brought in an occlusal film of this region which showed a radicular cyst of the left maxilla (Fig. 3). The patient was advised to have her whole mouth x-rayed, but refused.

On June 27, 1942, the patient returned, complaining of a discharge behind the lower right third molar and a slight swelling in this area.

Roentgen Examination.—An x-ray revealed a large cyst with scalloped appearance, involving the second and third molars as well as the angle and greater part of the ramus (Fig. 4).

Fig. 1.

Fig. 2.

Operation.—Under local anesthesia the cyst and the second and third molars were removed. The interior of the ramus was similar in appearance to the x-ray with incomplete septa across the cavity.

Postoperative course was normal.

Pathologic Examination (Jewish Hospital, Brooklyn).—Macroscopic description: The specimen consists of numerous portions of grey white tissue measuring 3.5 by 2.5 by 0.2 cm., said to be the wall of a cyst removed from the

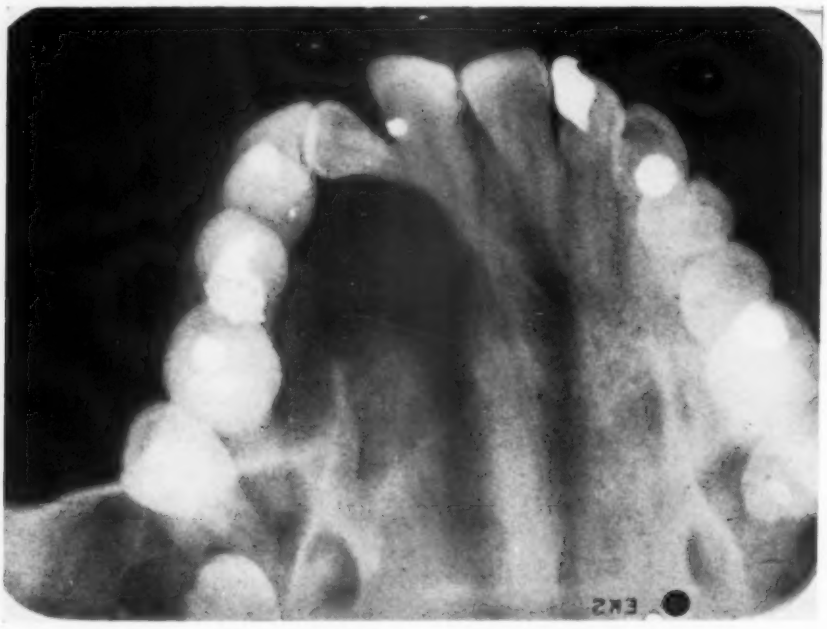

Fig. 3.

Fig. 4.

ramus of the mandible. Microscopic examination shows a cyst wall of a thin membranous structure made up on one surface of areolar fibrous tissue rather loosely arranged, and covered by a narrow strip of stratified squamous epithelium (Fig. 5). Diagnosis: Dermal cyst from mandible.

At this time the patient's whole mouth was x-rayed, but no other cyst was discovered.

Microscopic Examination (Laboratory of Oral Pathology, Harvard University).—The section sent to the laboratory for review shows a folded connec-

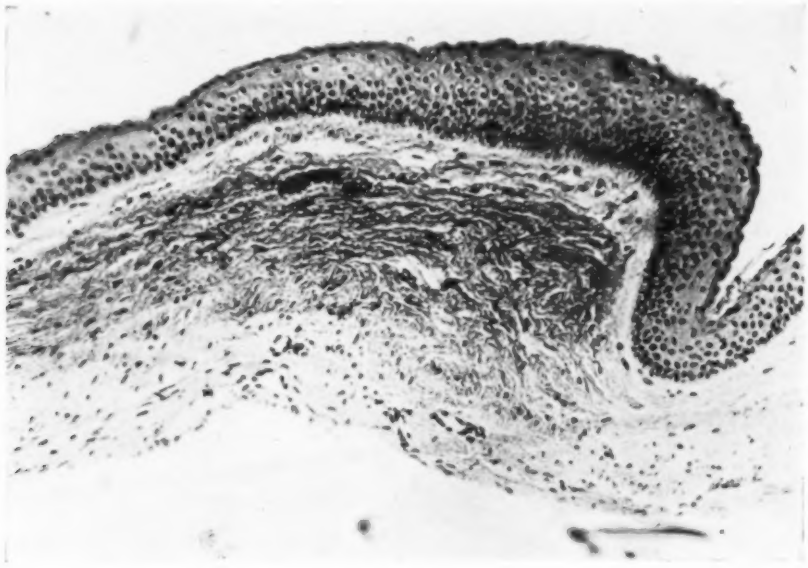

Fig. 5.

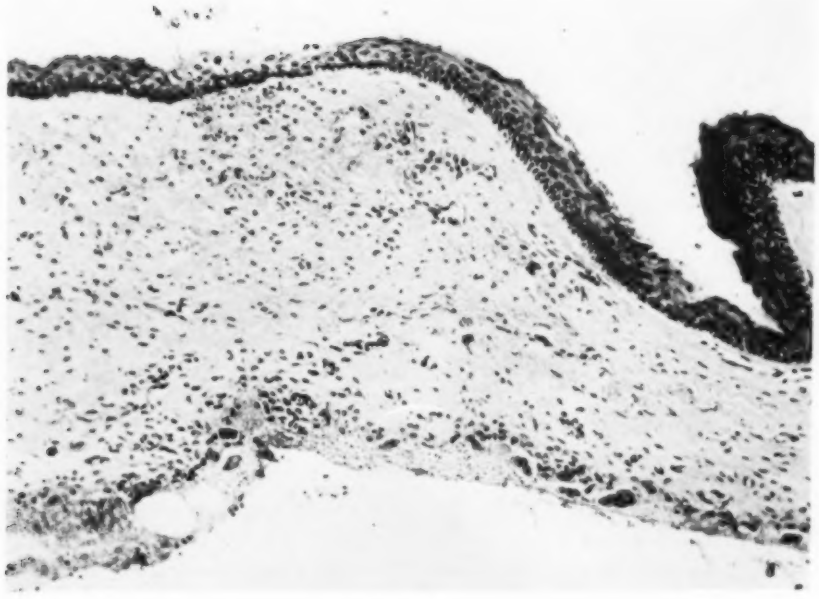

Fig. 6.

tive tissue membrane. It is lined by a well-marked layer of stratified squamous epithelium. There is some evidence of inflammatory infiltration in the connective tissue; this is of the round cell variety. The epithelium shows evidence of pearl formation and hyperplasia, and hyperkeratosis. In some instances

large bundles of desquamated cells are seen to be given off into the lumen. In parts of the specimen there is evidence of hemorrhage which is probably due to operative trauma. In some areas we see rhomboid spaces which are evidence that there were deposits of cholesterin crystals in considerable amounts. At the peripheral side of the connective tissue we find in one place numerous foreign body giant cells which may be osteoclasts that have helped to resorb the bone in an effort to expand the cyst (Fig. 6). Diagnosis: Odontogenic cyst with chronic inflammation.

Comment.—I consider this case of great interest because of the presence of three very large cysts in different parts of the jaw. The common feature is that all were associated with teeth having amalgam fillings. The unusual appearance of the last cyst in the roentgen film and at operation suggested a multilocular cyst or adamantinoma, but the histologic evidence is against this. Probably a part of the original cyst perforated a small part of the spongy bone, increased in size, and again repeated this process. The intervening septa were gradually destroyed by atrophy.

857 Eastern Parkway

CASE NO. 84

MYXOMA OF MAXILLA

RAYMOND E. FONVILLE, PH.G., D.D.S., AND JULIUS G. GODWIN, D.D.S.,
HOUSTON, TEXAS

THE patient, V. D., a Mexican housewife, 44 years old, had noticed a marked swelling in the upper jaw for the past four months. Six to eight months previously, several teeth had been extracted on that side. On Sept. 18, 1942, she consulted the Ear, Nose, and Throat Clinic of Jefferson Davis Hospital and was referred to the dental clinic.

Clinical Examination.—The patient was a well-nourished and well-developed Mexican woman. There was a slight swelling noticeable on the left side of the face. The skin over that area was normal in appearance.

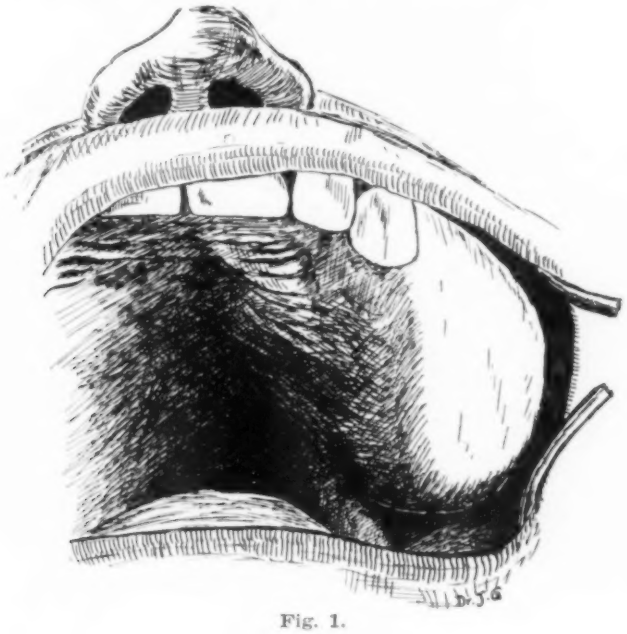

Fig. 1.

Intraorally a huge swelling could be seen in the left upper premolar and molar region. There was considerable bulging of the growth toward the buccal surface (Fig. 1). The overlying mucous membrane was smooth and normal in tone and color. The swelling was hard and firm. No pain was experienced by the patient at any time. The premolars and molars on that side were missing.

The cervical lymph nodes were not involved. The Kline and Kolmer reactions were negative. Urinalysis and hematology findings revealed nothing abnormal.

Roentgen Examination.—Roentgenograms showed a rarefied area extending from the canine region to the third molar region, and protruding well on the

From the Dental Department, Jefferson Davis Hospital, Houston, Texas.

buccal surface. Numerous interlacing whorls of fine, dense fibers could be seen in the rarefied area (Fig. 2).

Operation.—Under local anesthesia the tumor was excised. A large muco-periosteal flap was made in the upper left premolar and molar regions and the

Fig. 2.

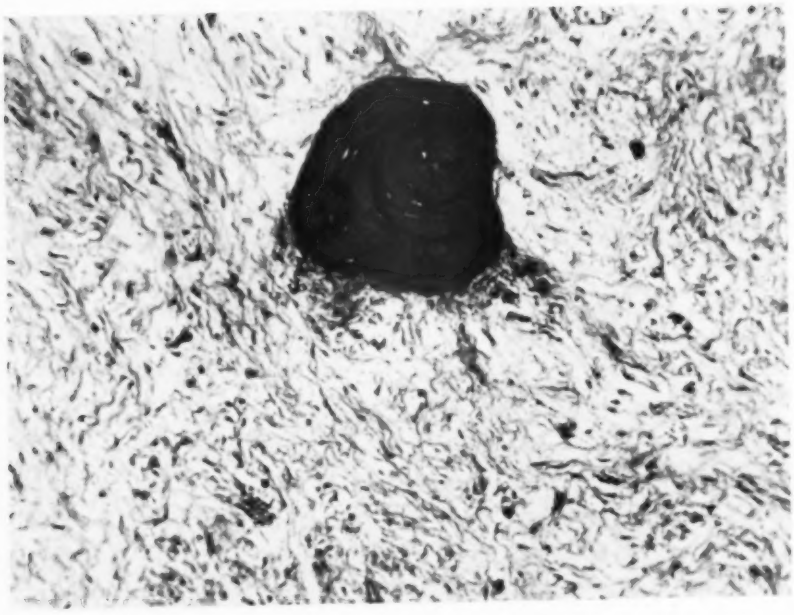

Fig. 3.

tumorous mass removed by careful curettage. The tumor extended into the malar process. The antrum wall was invaded. After removal of the tumor, the flap was sutured into place. The patient made an uneventful recovery with no postoperative discomfort.

Examination of Excised Tumor.—Gross description: The specimen consists of several pieces of moderately soft, friable, light gray tissue. The surfaces have a moderate amount of sticky, stringy, semifluid material attached. There are several bone spicules. Microscopic examination: Sections show a meshwork of fine, wavy fibers, interlacing and forming bundles in an irregular manner. The density of the meshwork varies considerably, but most of the fibers are loosely arranged. Distributed between the fibers are a moderate number of dark staining, slender, elongated cells, some of which are stellate. These cells have a scanty acidophilic cytoplasm which appears mainly confined to the cellular processes. Small spicules of bone are seen, some of which show an abnormal degree of calcification and sclerosis (Fig. 3). Thionin stain for mucin shows numerous dark purple areas. Diagnosis: Myxoma of maxilla.

The patient was seen several times during the last six months for check-ups, and there was no local evidence of recurrence of the tumor thus far. Roentgenograms show a gradual filling in of bone in the area from which the tumor had been removed. The patient is being kept under observation.

Medical Arts Building

Editorial

Prophylactic Chemotherapy

As early as 1940 the value of the prophylactic use of the sulfa drugs was recognized by the British Royal Army Medical Corps.* In civilian practice also, these drugs have proved of inestimable value, in medicine as well as in surgery. Both local application and internal administration may be advantageous. The oral surgeon, who is frequently called upon to operate in a septic field, has, therefore, an opportunity to apply the use of chemotherapy to his work.

Although the fact is not generally understood, one of the greatest benefits of chemotherapy is its use to protect the patient from the spreading of infection when surgical interference is indicated. The prophylactic use of chemotherapy is indicated in acute infections before making incisions for drainage, and in pericoronal, apical, or periodontal infections before eradicating the focus. This treatment permits the focus to be removed at the same time the abscess is opened, either in the mouth or on the outer surface of the face. Its purpose is to prevent spreading of the infection locally as well as through the blood stream, and thus to allay the danger of septicemia or pyemia.

Since the development of chemotherapy, surgical treatment in the presence of local infections may be attempted in a bolder manner than has been possible before. Multiple extractions for eradicating dental and periodontal infections may be planned in one operation, and cases of osteomyelitis of the jaw may be treated surgically by means of saucerization or extensive sequestrectomy with less danger to the patient and with the prospect of decreasing the treating time. The patient is thus protected from temporary bacteremia which might cause various complications. Similarly sulfonamides should be given before excising infected cysts or performing any other operation on an infected lesion. It is of great value if used before reducing fractures of the mandible, especially the comminuted and compound variety, and all fractures of the maxilla and adjoining bones.

Chemotherapy has a further important application in the protection of the patient with metastatic infections such as endocarditis when teeth harboring chronic foci of infection are to be removed.

The sulfa drugs may be administered intravenously instead of orally in cases where it is necessary to effect a greater blood concentraction. This is sometimes indicated in serious infections or in accident cases in which operative procedures have to be undertaken at once.

The local use of the drugs is recommended not only in all infected wounds, but also in clean operative wounds, especially those to be closed by suture. However, local chemotherapy is generally used in conjunction with general therapy. The effect of local application lasts only until the drug has been

*Royal Army Medical Corps Memorandum, Lancet 2: 996, 1939.

absorbed, and absorption of sulfanilamide generally takes place in twenty-four hours, and, if course, does not cause a blood level of sufficient concentration or duration to do much good. Powdered sulfanilamide does not interfere with the healing of wounds, but it should not be packed into cavities in unnecessarily large amounts. Nor should it be looked upon as a panacea allowing the surgeon to relax the standards of asepsis or lulling him into a false security and the laying aside of well-established surgical principles. While chemotherapy makes it possible for surgery to be performed despite the presence of acute draining infection, it does not justify discontinuance of drainage after operation. It might also be well to repeat here that while chemotherapy may prevent abscesses in the fascial spaces about the jaws when edema develops in response to dental infections, it does not cure the focus. Localized suppurative foci are notoriously resistant to chemotherapy and it is necessary to combine the latter with surgical treatment in order to eradicate the primary lesion.

Lockwood (1940)* gives some practical advice regarding the use of chemotherapy in surgical infections. Those of interest are herewith repeated.

Diffuse Cellulitis and Lymphangitis.—Prophylaxis: Chemotherapy by mouth for five days is probably of value in severely traumatized, contaminated wounds and compound fractures, but only in conjunction with, and not as a substitute for, thorough débridement and cleansing of the wound. Local implantation of sulfanilamide crystals in compound fracture wounds has been reported to be very effective.†

Treatment: Full doses should be used for the first forty-eight hours, followed by gradually diminishing doses until the seventh day. The management thereafter will depend on whether or not localized abscess formation has occurred. Immobilization and heat should be used in conjunction with chemotherapy.

Acute Lymphadenitis.—Prophylaxis: Prophylactic treatment consists of the early treatment of cellulitis and lymphangitis.

Treatment: When suppuration is doubtful, chemotherapy is used until fever and local signs of acute inflammation subside, usually for seven to ten days. Complete resolution will not occur if pus is present. When suppuration is definite, chemotherapy may be used for one or two days, after which the abscess should be incised and drained. Chemotherapy may then be continued for a few days, depending on whether there is any residual peripheral cellulitis.

Soft Tissue Abscess.—Prophylaxis: Early treatment of cellulitis may prevent abscess formation.

Treatment: Surgical drainage is indicated. Chemotherapy should be used only if cellulitis also is present.

Suppurative Thrombophlebitis.—Prophylaxis: The avoidance of continuous venoclysis in septic patients is probably desirable.

Treatment: Chemotherapy is of limited value in attacking the local lesion but should be used in full doses in order to limit dissemination. Heparin may be of value in limiting propagation of the thrombus. Ligation of the vain proximal to the area of infection may be helpful in special cases.

Septicemia.—Prophylaxis: Chemotherapy and immobilization should be applied to early lesions likely to lead to septicemia. Surgical procedures should be avoided in diffuse cellulitis, but, if unavoidable, the use of sulfanilamide before and after operation may help to minimize dissemination.

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*Lockwood, J. S.: Sulfanilamide in Surgical Infections, J. A. M. A. 115: 1190, 1940.

†Jensen, N. K., Johnsrud, L. W., and Nelson, M. C.: Local Implantation of Sulfanilamide in Compound Fractures, Surgery 6: 1, 1939.

Treatment: Chemotherapy is indicated in full doses. If the drug is effective, marked clinical improvement is usually evident within forty-eight hours. The prognosis is much better if foci of distribution or localization can be drained. Frequent small (250 c.c.) transfusions of fresh whole blood are probably helpful. Intravenous "double potency" bacteriophage* is promising in staphylococcic septicemia, particularly in conjunction with chemotherapy.

Osteomyelitis.—Sulfonamide therapy may be directed against the dissemination of the infection but it is probably of only limited value in the treatment of established bone foci. It should be used during and for a few days after surgical procedures likely to cause dissemination.

Pulmonary Abscess.—Chemotherapy is apparently of little or no value because the organisms are drug resistant and the lesions are characterized by extensive necrosis.

Pleuritis and Empyema.—Prophylaxis: Chemotherapy might be of value if used before and after pneumonectomy or lobectomy. Chemotherapy of pneumonia tends to prevent empyema.

Treatment: Chemotherapy and drainage by aspiration may be used if the exudate is serous. Resolution without the necessity for open drainage is likely under these conditions. Rib resection and drainage will be required as soon as the exudate is frankly purulent. Sulfonamide therapy in small doses after operation may shorten the period of drainage.

Meningitis.—Prophylaxis: Prophylactic treatment consists of sulfonamide treatment of otitis media, mastoiditis, and invasive sinusitis, in combination with appropriate surgical measures. Chemotherapy alone will not insure against a late spread of infection to the meninges from a suppurative focus on bone or blood vessels, but will sometimes mask the existence of such a focus.

Treatment: Chemotherapy should be instituted in full doses by mouth or parenterally. Some authorities recommend administration of the drug intrathecally as well.† The use of a drug having specific bacteriostatic effect on the causative organism may bring about marked clinical improvement and clearing of the spinal fluid, but relapse is very likely to occur unless the focus that feeds the spinal fluid can be drained or removed. Treatment should be continued in gradually diminishing doses for at least two weeks after apparent clinical recovery. Most of the cures in meningitis due to hemolytic streptococci, pneumococci, and staphylococci are a result of skillful and timely surgery in conjunction with chemotherapy and are not by any means due to the drug alone.

Chemotherapy should be properly used. Certain patients who have been given chemotherapy before may have acquired a sensitivity to sulfonamide compounds. Statistical evidence published in 1941 by Lyons and Balberor‡ indicates that approximately one-third of all patients treated with sulfonamide drugs develop a sensitivity to these drugs sufficient to interfere with their subsequent use on these patients. Other investigators have shown that this sensitivity usually develops about nine days after the first administration of the drug and may persist for at least two years.§ The dominant symptom of the resulting "sulfonamide shock" is a prompt febrile reaction, often reaching higher than 104° F., accompanied by chilliness, erythema, pruritis, and conjunctival injection. In other patients the sulfonamide compounds cause

*Longacre, A. B., Jern, H. Z., and Meleney, F. L.: The Treatment of Staphylococcic Septicemia With Bacteriophage, Surg., Gynec. & Obst. **70**: 1, 1940.

†Neal, Josephine B.: The Treatment of Acute Infections of the Central Nervous System With Sulfanilamide, J. A. M. A. **111**: 1353, 1938.

‡Lyons, R. H., and Balberor, H.: Univ. Hosp. Bull., Ann. Arbor **7**: 19, 1941.

§Gallagher, J. R.: New England J. Med. **221**: 132, 1939.

various disorders. The most serious ones include changes of the blood, such as hemolytic anemia, acute agranulocytosis, and leucemoid reactions.* The occurrence of thrombocytopenic purpura has been reported.† This may be associated with prolonged bleeding time, the clotting time being normal but the clot failing to retract in twelve hours. Among other untoward reactions may be mentioned toxic effects on the kidneys. Crystals in the urine, and hematuria are important danger signals. Deaths during sulfathiazole therapy have been reported by Lederer and Rosenblatt (1942).‡

It is evident that patients receiving chemotherapy should be hospitalized so that they can be carefully observed and have such laboratory tests as may be indicated. Blood counts and urine analysis are important and should be repeated in prolonged administrations of the drugs. For prophylactic effect the patient should be given sulfonamides at least twenty-four to forty-eight hours before the operation. A blood concentration of 8 to 10 mg. per cent is satisfactory. After the operation, if there is sepsis present, the treatment should be continued for several days. Generally six to ten days are sufficient. After discontinuance of the drug, the patient should be observed for another twenty-four hours before being discharged from the hospital.

K. H. T.

*Kracke, R. R., and Townsend, E. W.: The Effect of Sulfonamide Drugs on the Blood Platelets, J. A. M. A. **122**: 168, 1943.

†Ibid., and Hurd, R. W., and Jacox, R. F.: Complications of Sulfathiazole and Sulfadiazine Therapy, J. A. M. A. **122**: 296, 1943.

‡Lederer, M., and Rosenblatt, P.: Death During Sulfathiazole Therapy, J. A. M. A. **119**: 8, 1942.

Abstracts and Reviews

The Clinical Use of Penicillin: By W. E. Herrell, *Proc. Staff Meetings, Mayo Clinic* **18**: 65, 1943.

Penicillin which is not pyrogen-free may be administered locally in the treatment of infection owing to susceptible organisms, although other substances of similar antibacterial activity are easily available for local use. These include the sulfonamides and gramicidin, also the synthetic quaternary ammonium compounds. Penicillin may be administered by mouth, but must be protected against the acid phase of the stomach which renders the substance impotent. The substance, penicillin, may be also given by the intravenous route and should be continuous, insuring a more uniform and continuous contact between the antibacterial agent and the bacteria involving the blood stream. Periodic intravenous injections of relatively large amounts of penicillin may result in the development of the so-called penicillin-resistant or penicillin-fast pathogens. For the treatment of moderately severe or severe infection, 30,000 to 40,000 Oxford units per 24 hours is, in the opinion of the author, an adequate amount. The detailed method of its use is given in this article.

D. W.

Premaxillary Cysts: By H. T. Roper-Hall, *Brit. Dent. J.* **74**: 197, April, 1943.

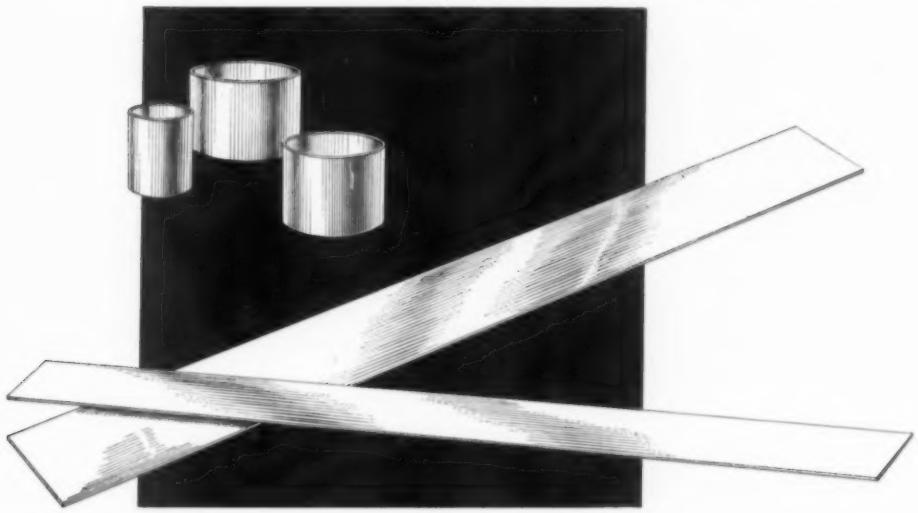
The author divides the cysts of the premaxilla into anterior cysts of non-dental origin, fissural cysts of developmental origin occurring in the alveolus between the lateral incisor and its neighbor, and incisive canal cysts of non-dental origin arising in the midline of the premaxilla behind the teeth. This article gives useful data on diagnosis of these various cysts and also includes excellent case histories on some of the operated cysts.

D. W.

Maxillo-Facial Injuries in Malta: By Capt. D. I. Rugg-Easey, *Brit. Dent. J.* **74**: 37, January, 1943.

The fractures of the maxilla consisted of horizontal fractures, midline separation of the maxilla, and fractures of the mandible at the symphysis. Treatment was by wire cradle splints combined with plaster headcap and chin support. Most of the fractures of the mandible were bilateral. These latter fractures were treated by eyelet wiring and a few were treated by arch wires. There was, in all cases, extensive involvement of the soft tissues. The average time for clinical union of the fractures was seven weeks. Prompt treatment of all cases was thought to be the most important contributing factor in early repair.

D. W.



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